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AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1831.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

[Continued from page 154, vol. vii.]

Having given a general description of the apparatus used in the experiments, the Committee proceed to state the methods employed in estimating the resistance arising from friction.

Experimenters have differed in the results of their investigations of the laws of friction. It results from the experiments of Coulomb, that the friction at the axle of a wheel, or of a roller, varies in the direct ratio of the pressure upon the axle, except in extreme cases. The late experiments of Mr. Rennie* indicate that when unguents are used, the ratio of friction to pressure is not the same for different pressures, the variation depending upon the nature of the unguent and the amount of pressure applied.

The Committee deemed it necessary, therefore, to determine with the apparatus to be used in their experiments, and under the probable loads to which it would be subjected, the relation between the friction and weight. It will be seen that this labour was much abridged by the fact that the experiments showed the ratio of friction to pressure to be constant, within the limits required by the investigations.

The experiments of Rennie have satisfactorily established that the

* Transactions of Royal Society of London, Part I. 1829, pp. 163 and 164; or Journal of Franklin Institute, Vol. V. No. 2.

friction of an axle remains the same, in proportion to the weight, under different velocities.

The frictions to be estimated by the committee, were those at the axis of the water wheel, and at the axis of the roller, or drum, above the wheel.

To ascertain the amount of friction at the axis of the wheel, a cord was wound about the barreling of the shaft; to this cord was attached a weight varied until it just maintained a velocity of six feet per second in the periphery of the wheel: the weight, thus found, gave the friction upon the gudgeons, when pressed by the weight of the wheel together with the weight representing the friction. The pressure upon the gudgeons being increased, by attaching masses of lead to the wheel at equal distances from, and on opposite sides of, the axis, the friction was found in the cases tried, viz. those within the probable limits of the weights to be borne in the experiments, to be proportional to the weight sustained by the gudgeons of the wheel. The proportion of friction to weight was found to be one and a half per cent.

The friction at the axis of the drum was ascertained by passing a cord over it; to the ends of this cord weights were attached, and the additional weight necessary to cause either extremity to descend with a uniform velocity, gave the amount of friction. By varying the weights at each end of the cord, it was found that in this case, as in that of the wheel, the friction was proportional to the weight borne by the gudgeons, and that the proportion of friction to the weight was one and a half per cent. This latter circumstance tends, as well as the former, to simplify the calculations relating to friction. The weights having been raised by the wheel through the intervention of a chain passing over a drum above, it is evident that the axis of the wheel was drawn upwards with a force due to the tension of the chain between the axis and the drum, that is, to the weights attached to the chain, thus diminishing the pressure upon the axis of the wheel, and lessening, in consequence, the amount of friction; but this tension increased the pressure upon the axis of the drum, and since the friction at that axis, by a given weight, was the same as that at the axis of the wheel, these two opposite effects balanced each other, and there remained the friction due to the weight applied to the chain.

As reference is necessarily made, in the calculations which follow, to the centres of gravity of the loaded parts of the wheel, it may not be amiss to state the manner in which these points were determined. The general remarks apply to the several wheels used, but the details refer to the largest wheel.

The water was supposed to be distributed uniformly over the loaded part of the wheel, a supposition very nearly accurate when the buckets are numerous and the wheel works within a close breast. A section of the wheel perpendicular to the axis, and midway between the rims, being taken, the weight of the water was supposed to be concentrated in that part of the periphery of a circle, a mean between the circles containing the interior and exterior edges of the buckets, which corresponded to the loaded part of the wheel. In Fig.

I, Plate V, *a*, *b*, *g*, represents the semi-circumference of this circle, a mean between the semi-circumferences A, D, F, I, and K, L, M, of Fig. I, Plate IV, the radius being 9 feet 9 inches in the case figured, viz. that of the large wheel. To find the arcs corresponding to the loaded portions of the wheel, this circle was described upon a large scale; the several points answering to those at which the water, admitted to the wheel through apertures Nos. 1, 2, &c. (Fig. I, Plate IV,) first struck the wheel, were laid down, as at *a*, *b*, *c*, *d*, *e*, and *f*, (Fig. I, Plate V,) the lowest point of the wheel, *g*, being taken as the point at which the water was discharged, the arcs sought were *acg*, *bcg*, *cdg*, *deg*, *efg*, and *fhg*. The centre of gravity of each of these arcs, was then found by the usual method. The diagram shows the chords, *ag*, *bg*, *cg*, &c. from which the lengths of the arcs were obtained, the lines bisecting these chords, and upon which the centres of gravity of the arcs are to be found, *ci*, *ck*, *cl*, &c., and upon these lines the points corresponding to the centres of gravity, viz. G, G′, G″, G‴, G^{iv}, G^{v}. By drawing lines parallel to *ag*, from the points thus found, the distances from the axis of the wheel, obtained by calculation, are shown upon the scale traced in the figure.

We shall now give the calculations of the amounts of resistance from friction, in the wheel and drum, under the various loads to which they were subjected in the course of the experiments.

First. Constant *inactive* weight borne by the gudgeons of the wheel and drum during the experiments.

Weight of the water wheel, -	2200 lbs.	
The whole weight of the chain was 318 lbs.; of this an average weight of 34 lbs. (20 feet of the chain,) rested upon the ground during each experiment, and that part of the chain between the barrel of the shaft and the ground (20 lbs.) acted to resist the motion of the wheel: deducting, therefore, 54 lbs. from the weight of the chain, we have for the constant *inactive* weight upon the gudgeons of the wheel and drum, derived from the chain, -	264 ,,	
Weight of the drum, - -	200 ,,	
Total constant inactive weight, -	2664 lbs.	
The friction upon this, at one and a half per cent, is - - - - -		39.96 lbs.

Second. Constant weight *resisting* the motion of the wheel, which was borne by the gudgeons of the wheel and drum.

That part of the chain which was between the barrel of the shaft of the wheel and the ground, - - - -	20 lbs.	
The iron basket used to contain the weight,	126 ,,	
Three bars of lead, weighing together	111 ,,	
Total constant resisting weight, - -	257 lbs.	

Friction due to this weight at one and a half per cent, - - - - 3.85 lbs.

The total friction derived from the *constant weight*, is, therefore, - - 43.81 lbs.

The amount of friction due to the constant weight having been thus found, we proceed to the numbers which varied with the weights added in the experiments, and with the points of admission of water to the wheel.

CHUTE No. 1. (Fig. I, Plate IV.)

The centre of gravity of the water in the buckets of the wheel when supplied by this aperture, was 6.207 feet from the axis, and the barrel about which the chain was wound was 1 foot from the same axis; hence to raise 257 lbs. the constant resisting weight, and overcome a friction of 43.81 lbs. the constant friction just found, required a weight of water of - - - - 48.46 lbs.

The friction due to this weight, is - 0.73 lb.
Constant friction derived above, - - 43.81 „

Whole amount of friction overcome in raising the constant weight of 257 lbs. - 44.54 lbs.

To find the additional friction due to each of the bars of lead which were used as weights, we have,

Weight of the bar, - - 103.00 lbs.

To balance this weight and the friction due to it, (103 lbs. + 1.54 lb.) or 104.54 lbs. required, at 6.207 ft. from the axis, a weight of water of - - - 16.84 „

Total, - - - 119.84 lbs.

Friction for each bar of lead, being that upon the weight just found at one and a half per cent. - - - - 1.80 lbs.

CHUTE No. 2. (Fig. I, Plate IV.)

In this case the centre of gravity of the water in the buckets, was 7.01 feet from the axis, to raise 257 lbs. and overcome the friction of 43.81 lbs. required, - - - 42.91 lbs.

Friction due to this, - - 0.64 lb.
Constant friction as above, - - 43.81 „

Total friction due to constant weights, - 44.45 lbs.

For each additional bar of lead,—		
Weight of the lead, -	103.00 lbs.	
To balance this weight and the friction due to it, - - -	14.91 ,,	
Total, - - -	117.91 lbs.	
Friction for each bar of lead, -		1.77 lbs.

CHUTE No. 3. (Fig. I, Plate IV.)

The centre of gravity of the load was in this case 6.58 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required, - - -	44.72 lbs.	
Friction due to this, - -		0.68 lb.
Add as before, - - -		43.81 ,,
Total friction due to constant weight, -		44.49 lbs.
For each bar of lead which was added,—		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and its friction,	15.88 ,,	
Total, - - -	118.88 lbs.	
Friction due to each bar, - -		1.78 lbs.

CHUTE No. 4. (Fig. I, Plate IV.)

The centre of gravity of the load was 5.89 feet from the axis: to raise 257 lbs. and overcome the friction of 43.81 lbs. required -	51.07 lbs.	
Friction due to this, - -		0.76 lb.
Add as before, - -		43.81 ,,
Total friction due to constant weights,		44.57 lbs.
For each bar of lead added,—		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and its friction,	17.74 ,,	
Total, - - -	120.74 lbs.	
Friction due to each bar, - -		1.81 lbs

CHUTE No. 5. (Fig. I, Plate IV.)

The centre of gravity of the load was 4.84 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required -	62.15 lbs.	
Friction due to this, - -		0.93 lb.
Add as before, - -		43.81 lbs.
Total friction due to constant weights, -		44.74 lbs.
For each bar of lead added,—		

Weight of the lead,	103.00 lbs.	
To balance this weight, and its friction, required,	21.59 ,,	
Total,	124.59 lbs.	
Friction due to each bar,		1.87 lbs.

The water delivered through Chutes Nos. 5 and 6, acts principally by impulse, at nearly the extremity of the radius of the wheel; this remark applies to No. 5, more exactly, when the head of water above the aperture is considerable; for all heads above four feet, the centre of force was taken at nine feet from the axis.

Not only is the arm of the lever, upon which the water from apertures Nos. 5 and 6 acts, greater, but the direction of the impulse does not coincide with that of gravity, hence the amount of pressure is not the same with the weight, or the ratio of friction to the weight must be diminished. The friction for Chute No. 6, and for Chute No. 5, when the head is more than four feet, may be taken at three-fourths per cent of the weight. The amount of friction being but small, nice calculations upon these points would have been entirely useless.

CHUTE No. 5.—When the head is above four feet.

To raise 257 lbs. and overcome a friction of 43.81 lbs. requires a weight of water, at 9 feet from the axis, of	33.42 lbs.	
Friction upon this at three-fourths per cent,		0.25 lb.
Add as before,		43.81 ,,
Total friction due to constant weights,		44.06 lbs.
For each additional bar of lead,—		
Weight of bar 103 lbs. friction at one and a half per cent,		1.54 lbs.
To balance this weight and its friction, required	11.62 lbs.	
Friction upon this at three-fourths per cent,		.09 ,,
Friction due to each bar,		1.63 lbs.

CHUTE No. 6. (Fig. I, Plate IV.)

The friction was sensibly the same with that for Chute No. 5, when the head at that chute was above four feet. Hence, the friction due to the constant weights was,	44.06 lbs.
And the friction for each bar of lead,	1.63 lbs.

CHUTE No. 7.—Undershot.—(Fig. I, Plate IV.)

Here the water acting entirely by impulse, the centre of force may be assumed at 9.75 feet from the axis.

To raise 257 lbs. and overcome a friction of 43.81 lbs. required, at 9.75 feet from the axis, a weight of - 30.85 lbs.
Friction upon this at three-fourths per cent, 0.23 lb.
Add as before, - - - 43.81 lbs.

Total friction due to constant weights, - 44.04 lbs.

For each bar of lead added,—
Weight of bar 103 lbs. Friction upon this at one and a half per cent, - - 1.54 lbs.
To balance this weight and its friction, required - - - - 10.72 lbs.
Friction upon this at three-fourths per cent, 0.08 ,,

Friction due to each bar, - - 1.62 lbs.

The foregoing calculations were applicable until nine leads, (927 lbs.) had been added to the constant weight in the basket; this weight suspended the end, *o*, (Plate III. Vol. vii.) of the shaft of the wheel. Any addition of weight to this, pressed the gudgeon against its cap with a force which was to the tension of the chain produced by the weight added, as the distance from the point at which the chain acted to the other gudgeon, (*o'*, Plate III.) was to the whole length of the shaft. The whole length of the shaft was 9.25 feet, the point of suspension 1.66 feet from the end *o*, of course 7.59 feet from *o'*. If one lead of 103 lbs. be added to the nine supposed in the basket, the force drawing the shaft upwards will be 103 lbs. together with its friction 1.54 lbs. or 104.54 lbs.; to find its effect upon the gudgeon, *o*, we have the proportion, 9.25 : 104.54 : : 7.59 : 85.78, the force, in pounds, with which the gudgeon, *o*, is pressed against its cap. Subtracting this weight from 104.54 lbs. the total weight from which both the gudgeons are relieved, there remains 18.76 lbs. the force tending to draw the gudgeon *o'* upwards, or the weight from which that gudgeon was relieved.

To ascertain the friction when more than nine leads were added to the constant weight in the basket, we have,
Friction due to the weight of each lead of 103 lbs. - - - - 1.54 lbs.
Tension of chain between axis of wheel and drum pressing upon the gudgeons of the drum, - - - - 104.54 lbs.
Force with which gudgeon *o* was pressed against its cap, - 85.78 lbs.
From this deduct the weight from which the gudgeon *o'* was relieved, 18.76 ,,

There remains the pressure upon the axis of the wheel, - - - 67.02 lbs.

Total pressure upon the gudgeons of the

wheel and drum, by the addition of each lead after the ninth, - - - 171.56 lbs.
Friction upon this at one and a half per cent, - - 2.57 lbs.

Friction due to each lead after the ninth, exclusive of the water required to overcome this friction, - - - - 4.11 lbs.

When the water was admitted to the wheel through Chute No. 1.

To overcome 103 lbs. and the friction of 4.11 lbs. or 107.11 lbs., required, at 6.207 feet from the axis, - - 17.26 lbs.
Friction due to this, - - - 0.26 lbs.
Friction just determined, - - - 4.11 lbs.

Total friction for each lead after the ninth, 4.37 lbs.

The friction due to the weight of water necessary to balance each additional lead and its friction, was so small that its variations when the water was applied through the different chutes, could with propriety be neglected. The variation from the friction given by Chute No. 1, in an extreme case, that of Chute No. 5, at a friction of one and a half per cent, is but .07 of a pound. The friction for each lead after the ninth, was, therefore, taken at 4.37 lbs. at all the chutes.

The necessary details in relation to the friction of the several smaller wheels, will precede the account of the experiments made with each of them.

Before passing to a detail of the experiments, it may assist the reader to give a brief statement of the principal points to which the researches of the committee were directed.

The first and most general subject for determination, was the mode of applying any given head of water, so as to produce the greatest ratio of effect to power expended.

To ascertain this point, regard was to be had to, and variations made in, the head of water, the diameter of the wheel, the point of application of the water to the wheel, the size of aperture through which water was admitted to the wheel, the form of gate which was applied to the chute, the form, number and position of the buckets, and the velocity of the wheel.

The second object was to determine for a given wheel, the form of bucket which would admit of the application of the greatest quantity of water, giving the maximum amount of effect, without diminishing the ratio and effect to power expended.

Wheels of four different diameters were used in the experiments; No. I, had a diameter of 20 feet, No. II, of 15 feet, No. III, of 10 feet, and No. IV, of 6 feet. A particular description of each wheel will precede the statement of the experiments made with it.

The experiments were begun with wheel No. I; this wheel, as has been stated in the general description, was 20 feet in diameter, 20

inches in breadth, and 16 inches, in the clear, between the cants, which were 6 inches deep.

The buckets first attached to this wheel were *elbow buckets*, these were 15½ inches deep, with a width of elbow of 3 inches, and an opening at the throat of 2⅜ inches. In sector A, B, C, (Plate IV,) these buckets are represented, *e*, *e*, &c.: the number around the whole circumference was fifty.

In the bottom of each bucket an air vent was provided, ⅜ths of an inch wide and occupying the breadth of the wheel; each vent was placed in the upper part of the bucket, to which it belonged, as near as practicable to the elbow of the preceding bucket. The air vents were closed during the experiments when the contrary is not stated.

The overshot chute, delivering water to the wheel on the pitch-back principle, is represented at *d*, No. 1, Fig. I, Plate IV.

To this chute three different forms of gates were applied. The first, *a*, Fig. I, Plate IV, was formed of a block three inches thick, and was opened by a motion towards the right, given by the series of levers, *l*, *l'*, *l''*, K, Plate I, (Vol. vii.) already described. The width of opening given by this gate was regulated by a series of notches upon a block, affixed to the top of the forebay, against which the end of the connecting rod, *l'*, *l''*, (Plate I,) was carried. These notches were regulated by trial. The same method of gauging the width of the opening was applied to the other apertures. When gate *a* was opened, the water flowed between its end and the top of the chute. Table A contains the results of the experiments made with this gate, under different heads.

This series of experiments being completed, the gate *b*, Fig. II, Plate IV, was adapted to the same chute; this gate drew upwards, allowing the water to pass between the lower part of the gate and the floor of the chute. Experiments similar to those, with gate *a*, were then made; the results are given in table B.

Gate *c*, Fig. III, Plate IV, was next adapted to the same chute; this gate, of a wedge form, being drawn to the right, allowed the water to pass between the tops of the gate and of the sluice. Table C contains the results obtained with this gate.

The elbow buckets remaining in the wheel, experiments were made with different heads and different widths of aperture, the water being applied at Chutes Nos. 2, 3, 4, 5, 6, and 7 successively. These points of application, taken together with Chute No. 1, embraced the cases of overshot, breast and undershot wheels. The heights of the several apertures above the lowest point of the wheel are, No. 2, 17 feet; No. 3, 13.66 feet; No. 4, 10.46 feet; No. 5, 7 feet; No. 6, 3.66 feet. No. 7 was the undershot aperture. The horizontal lines *f g*, *h i*, *k l*, *m n*, and *o p*, show the points from which these several heights above the bottom of the wheel were reckoned. The chutes through which the water was delivered from these openings, were at the entrance 16 inches by 2½ inches, and contracted in depth (the width remaining invariable) to 2 inches, at the end where the water escaped to the wheel.

The three forms of gates (*a*, *b* and *c*) having been found nearly equally effective, either one could be applied as the convenience of

opening and closing, in the position to be assumed by the gate might dictate. Fig. I, Plate IV, shows that Chutes Nos. 2, 3 and 7, were closed by gates similar to *b*, and chutes Nos. 4, 5 and 6, by gates similar to *c*. The experiments with each chute, under the various heads, will form the subject of one table.

The required results having been obtained with the elbow buckets, they were removed from the wheel, and the buckets represented in sector F, C, G, (Fig. I, Plate IV,) substituted, the faces converging to the centre of the wheel. The different heads of water were then tried with each chute, and with different widths of aperture, as before. These experiments will be presented with the others in a tabular form.

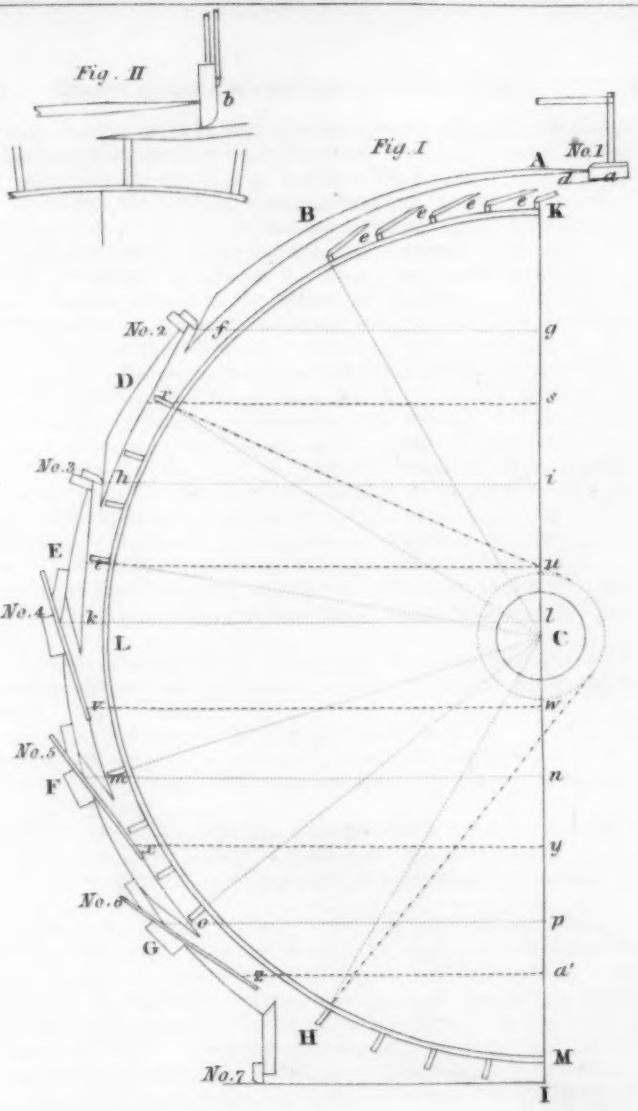
Air vents, similar to those already described, were provided in the bottoms of these buckets.

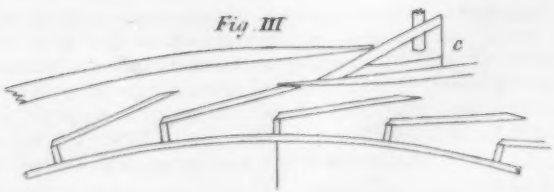
The series of experiments, with the *centre buckets* having been completed, the buckets figured in sector D, C, E, (Fig. I, Plate IV,) and afterwards those in sector H, C, I, were substituted. If from any point in the periphery of the wheel, two tangents be drawn to a circle, described with the centre of the wheel as its centre, and a radius of 15⅛ inches, we shall obtain the lines determining the two different buckets for that point; each bucket being equally inclined to, but on different sides of, the radius of the wheel drawn to the point, assumed, in the periphery. In sector D, C, E, the tangents to the upper side of the circle are drawn, determining the positions of the first set of *inclined buckets*. In sector H, C, I, the tangents to the lower side, giving the second set of inclined buckets.

In presenting the results of the experiments, each table will contain a single subject, and will be designated by a letter serving as a reference. To accommodate the tables to the size of the page, they will be divided into parts, designated by numbers. The general tables, as may be seen by table A, Part I, consist of 18 vertical columns, and in addition, a space for observations; each column has, at the bottom of the table, its appropriate figure of reference.

Column 1, contains the numbers by which any particular experiment may be referred to; the experiments are numbered from one upwards, through the whole extent of a table. The next three columns refer to the head of water used; column 2, containing the heights of water above the aperture; 3, the height above the top of the bucket, at which the water first strikes the wheel; and 4, the height above the bottom of the same bucket. The heads above the apertures were measured in apertures, Nos. 1, 2 and 3, by the heights above the lowest points of the tops of the gate-seats, in Nos. 4, 5 and 6, by the heights above the lowest points of the several gates when closed, and in No. 7, by the height above the bottom of the forebay, which was on a level with the bottom of the wheel. The lines *fg*, *hi*, &c. already referred to, are drawn through the points just designated, corresponding to apertures, Nos. 2, 3, 4, 5 and 6. The head, above the top of the bucket, was estimated for the overshot aperture, (No. 1,) by the height of the water above the highest point of the wheel; and that above the bottom of the bucket, by the height above the highest point of the soleing of the wheel. The heads, above the tops of the buckets, upon which the water first struck, were estimated for apertures, Nos. 2, 3, 4, 5 and 6, by the height of

Plate II.





Scale ¼ inch to the foot.

the water, above a point in each aperture, one-half of an inch distant from the periphery of the wheel; the horizontal lines drawn through these points are shown in Fig. I, Plate IV, by *rs*, *tu*, *vw*, *xy*, and *za'*. By adding the vertical distance between the top and bottom of the bucket at any aperture, to the head, found as just described, the head, above the bottom of the bucket, was obtained. The heads thus found are contained in column 4. In a wheel considered at rest, the point corresponding to the bottom of the bucket, at which the water was delivered, would give the first point of action of the gravity of the water upon the wheel; but when the wheel is in motion, this point is generally lower down than the point which we have determined, the distance depending upon the depth of the bucket, and upon the relative velocities of the water and wheel. All the dimensions referred to, are given in feet, and decimal parts of a foot.

Column 5 contains the width of aperture, regulated by the distance to which the gate was drawn, determined in the manner already explained. The openings were increased by determinate differences, until the supply of water was more than sufficient to fill the buckets. The widths of the openings are given in inches and decimals.

The weight raised is given in column 6; this was varied with each head and aperture, until the maximum effect was reached and passed.

The friction, the method of calculating which has been given, for the machine under the particular weight raised, is contained in column 7.

Column 8, is the sum of the weights found in 6 and 7 for the different cases; the numbers represent, therefore, the total resistance overcome by the power. The weights are all given in pounds and decimals of a pound.

Column 9 contains the height through which the several weights were raised, combined with 8, it gives the effect produced.

The time occupied in each experiment is recorded in column 10, in seconds.

By dividing the distance through which the weight was raised, by the number of seconds required to raise it through that distance, the rate per second, or velocity of the weight, was determined. The velocity of the wheel will of course bear the same proportion to that of the weight, as the radius of the wheel to the sum of the radii of the barrel and chain. To avoid any uncertainty in relation to this latter quantity, the ratio was obtained experimentally, by ascertaining the number of revolutions, and parts of a revolution of the wheel, required to raise the weight through a measured distance. The velocities of the wheel are given in column 11.

The weight of water expended in each experiment, determined by measurement of its bulk in the reservoir, is contained in column 12. It was a question, whether in these experiments which would occupy a period extending through a considerable range of temperature, it was necessary to apply a correction for the temperature of the water used, the water expended being measured, not weighed. Calculation showed that no such correction was necessary.*

* The temperature of the water used, was, during the winter, about at its point of maximum density, in the summer, not far from 75° Fahr. Calling the specific gravity of water at 39.38° Fahr. its point of maximum density, unity,

Column 13 contains the head and fall, expressed in feet and decimals.

By multiplying the numbers of column 12, by the corresponding heads and falls from 13, the powers expended were obtained; the numbers expressing them are in column 14. The decimal point is omitted in this and in the succeeding column, as being unnecessary to the determination of the ratio.

Column 15 contains the numbers denoting the effect produced; these were obtained by multiplying the corresponding numbers in columns 8 and 9.

The next column, 16, gives the ratio of effect to power expended, the power being taken as unity.

The maximum effect under each head and width of aperture, is placed in column 17, that reference may be more readily made to the several maxima.

Column 18 contains the velocity of the wheel, which gave the maximum in each case.

The observations made during the progress of the experiments, are recorded in the remaining space.

Two experiments were always made under the same circumstances, when the results of these agreed it was not deemed necessary to make a third, but when they were discordant, a third, and, when required, even a fourth experiment was made to ascertain the point in doubt.

To give the two or three experiments made in each case, would be to add unnecessarily to the space which the tables must occupy: the numbers given are to be considered as so many mean results taken by those who, having been actually engaged in the course of experiment, could duly appreciate the circumstances rendering expedient the rejection of any experimental result. The tables thus become more valuable, by being rendered less voluminous and better adapted to practical use.

The tables will be followed by remarks upon them, and conclu-

the experiments of Haellstroem give for its density at 75.2° Fahr. 0.9976. If we suppose two results are to be compared, one obtained at the minimum temperature of the water, the other at the maximum, they will differ but .0024ths of the greater weight. Thus in a weight of water expended, of 10,000 lbs. the greatest difference could be but 24 lbs., or less than one division upon the gauge-plate, a number which would disappear in the ratio. Take, for example, experiment 15, Table A, which gives the highest number, contained in Part 1st, for the weight of water expended; this number is 4810 lbs.: suppose this experiment to have been made when the water was at its maximum density, and let us ascertain what effect will be produced upon the ratio, if this experiment were supposed to have been made with the water at 75.2° Fahr. The weight of water expended, occupying the same bulk with 4810 lbs. at the maximum density of water, would have been at 75.2° Fahr. $4810 \times .9976$, 4798.456 lbs.; this multiplied by the head and fall, 23 feet, gives for the power expended 110364.49 lbs.; the effect, (column 15,) is 91759.4, the numbers in the columns for power and effect in the table are multiplied by ten to avoid placing the decimal point. But 1103645 : 917594 : : 1 : .831, the ratio sought.

The ratio in the table, (column 16,) is .829, differing but .002 from the number just found: the effect, therefore, of neglecting the change of temperature in this extreme case falls only upon the third decimal place, the figure in which place it alters slightly.

sions drawn from them; when necessary, tables will be given presenting condensed views of particular results which are to be compared with each other.

We proceed to give the tables relating to wheel No. I.

TABLE A.—PART I.

CHUTE No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Experi.	Head of water above. Bttm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.50	257	44.54	301.54	41.5	33	11.84	835	23.0	192050	125139	.652	- -	- -	Water carried above lower centre of wheel before it was discharged from buckets.
2					416	47.32	463.32		40	9.77	1100		253000	192278	.759			
3					463	48.14	511.14		44	8.88	1200		276000	212123	.768			
4					772	53.54	825.54		69	5.66	1825		419750	342599	.816			
5					875	55.34	930.34		74	5.28	2025		465750	386091	.829	.829	5.28	Water discharged at bottom of wheel.
6					931	56.32	987.32		83	4.71	2200		506000	409738	.809			
7					978	57.14	1035.14		86	4.54	2300		529000	429583	.812			
8					1081	58.94	1139.94		94	4.16	2575		592250	473075	.799			
9	2.75	3.00	3.60	1.00	1493	73.85	1566.85	41.5	68	5.75	3450	23.0	793500	650243	.820			
10					1549	76.22	1625.22		70	5.58	3525		810750	674466	.832			
11					1596	78.22	1674.22		72	5.43	3600		828000	694801	.839	.839	5.43	
12					1699	82.59	1781.59		80	4.88	3925		902750	739360	.818			
13	2.75	3.00	3.60	1.25	1905	91.33	1996.33	41.5	66	5.92	4350	23.0	1000500	828477	.828			
14					2008	95.70	2103.70		70	5.58	4550		1046500	873035	.834	.834	5.58	
15					2111	100.07	2211.07		74	5.28	4810		1106300	917594	.829			
16	2.25	2.50	3.10	0.75	875	55.34	930.34	41.5	57	6.86	2115	22.50	475787	386091	.811			
17					1081	58.94	1139.94		69	5.66	2575		579375	473075	.815			
18					1184	60.74	1244.74		75	5.21	2800		630000	516567	.820	.820	5.21	
19					1287	65.11	1352.11		82	4.77	3050		686250	561126	.817			
20					1390	69.48	1459.48		93	4.20	3330		749250	605684	.808			
1	2	4	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table A.—Part II.

Chute No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of Water above. Bttm. of gate.	Top of bkt.	Bttm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	2.25	2.50	3.10	1.00	1184	60.74	1244.74	41.5	56	6.98	2775	22.50	624375	516567	.827			
22					1287	65.11	1352.11		60	6.51	3000		675000	561126	.831			
23					1390	69.48	1459.48		65	6.01	3225		725625	605684	.835	.835	6.01	
24					1493	73.85	1566.85		70	5.58	3500		787500	650243	.826			
25					1596	78.22	1674.22		74	5.28	3750		843750	694784	.823			
26					1699	82.59	1781.59		79	4.95	4000		900000	739360	.821			
27	2.25	2.50	3.10	1.25	1390	69.48	1459.48	41.5	51	7.66	3300	22.50	742500	605684	.816			
28					1596	78.22	1674.22		60	6.51	3750		843750	694784	.823			
29					1699	82.59	1781.59		63	6.20	3975		894375	739384	.827			
30					1802	86.96	1888.96		68	5.75	4175		939375	783918	.834			
31					1905	91.33	1996.33		71	5.50	4400		990000	828477	.837	.837	5.50	
32	1.25	1.50	2.10	0.50	669	51.74	720.74	41.5	74	5.28	1660	21.50	356900	299107	.838			
53					772	53.54	825.54		84	4.65	1900		408500	342599	.839	.839	4.65	
34					875	55.34	930.34		94	4.16	2150		462250	386091	.835			
35					978	57.14	1035.14		100	3.91	2540		546100	429583	.787			
36	1.25	1.50	2.10	0.75	875	55.34	930.34	41.5	72	5.43	2150	21.50	462250	386091	.835			
37					978	57.14	1035.14		82	4.77	2350		505250	429583	.850	.850	4.77	
38					1081	58.94	1139.94		90	4.35	2600		559000	473075	.846			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table A.—Part III.

Table A.—Part III.

Chute No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum	Observations.
	Btm. of gate.	Top of Bkt.	Btm. of Bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	1.25	1.50	2.10	1.00	1081	58.94	1139.94	41.5	68	5.75	2600	21.50	559000	473075	.846			
40					1184	60.74	1244.74		74	5.28	2825		607375	516567	.850	.850	5.28	
41					1287	65.11	1352.11		81	4.83	3100		666500	561126	.842			
42					1390	69.48	1459.48		90	4.35	3400		731000	605684	.828			
43	1.25	1.50	2.10	1.25	1390	69.48	1459.48	41.5	70	5.58	3390	21.50	728850	605684	.831			
44					1493	73.85	1566.85		76	5.14	3650		784750	650243	.828			
45					1596	78.22	1674.22		81	4.83	3825		822375	694801	.845	.845	4.83	
46	0.50	0.75	1.35	1.25	875	55.34	930.34	41.5	62	6.30	2250	20.75	466875	386091	.828			
47					978	57.14	1035.14		67	5.83	2460		510450	429583	.842			
48					1081	58.94	1139.94		70	5.58	2675		555062	473075	.852			
49					1184	60.74	1244.74		77	5.07	2875		596562	516567	.866			
50					1287	65.11	1352.11		88	4.44	3100		643250	561126	.872	.872	4.44	
51					1390	69.48	1459.48		83	4.70	3400		705500	605684	.859			
52	0.25	0.50	1.10	0.75	360	46.34	406.34	41.5	62	6.30	1075	20.50	220375	168631	.765			
53					566	49.94	615.94		93	4.20	1550		317750	255615	.804			
54					669	51.74	720.74		98	3.99	1800		369000	299107	.810	.810	3.99	Water too low to fill the aperture.
55	0.25	0.50	1.10	1.00	772	53.54	825.54		96	4.07	2025		415125	342599	.825			
56					875	55.34	930.34		104	3.76	2275		466375	386091	.828	.828	3.76	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE B.

CHUTE No. 1.—*Gate b. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt.of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.75	1287	65.11	1352.11	41.5	45	8.69	3000	23.00	690000	561126	.813			
2					1390	69.48	1459.48		48	8.14	3200		736000	605684	.822			
3					1493	73.85	1566.85		52	7.52	3375		776250	650243	.838	.838	7.52	
4					1596	78.22	1674.22		55	7.10	3625		833750	594801	.833			
5					1699	82.59	1781.59		59	6.62	3875		891250	739360	.829			
6	2.75	3.00	3.60	1.00	1699	82.59	1781.59		46	8.50	3925	23.00	902750	739360	.819			
7					1802	86.96	1888.96		48	8.14	4125		948750	783918	.826			
8					1905	91.33	1996.33		51	7.66	4330		995900	828477	.832	.832	7.66	
9					2008	95.70	2103.70		55	7.10	4575		1052250	873035	.829			
10					2111	100.07	2211.07		58	6.74	4850		1115500	917594	.826			
11					2214	104.44	2318.44		60	6.51	5125		1178750	962153	.816			
12					2317	108.81	2425.81		63	6.20	5375		1236250	1006711	.814			
13	1.25	1.50	2.10	1.00	1390	69.48	1459.48	41.5	62	6.30	3400	21.50	731000	605684	.828			
14					1596	78.22	1674.22		71	5.50	3875		833125	694801	.834			
15					1699	82.59	1781.59		74	5.28	4100		881500	739360	.839	.839	5.28	
16					1802	86.96	1888.96		66	5.92	4350		935250	783918	.838			
17	0.75	1.00	1.60	1.25	1287	65.11	1352.11		66	5.92	3235	21.00	679350	561126	.826			
18					1390	69.48	1459.48		71	5.50	3450		724500	605684	.836	.836	5.50	
19					1493	73.85	1566.85		68	5.75	3725		782250	650243	.831			
20	0.50	0.75	1.35	1.25	1081	58.94	1139.94		73	5.35	2775	20.75	575812	473075	.821			
21					1184	60.74	1244.74		78	5.01	3000		622500	516567	.830			
22					1287	65.11	1352.11		84	4.65	3250		674376	561126	.832	.832	4.65	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

CHUTE, No. 1.—*Gate c. Pitch-back over-shot. Elbow-buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt.of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.75	1287	65.11	1352.11	41.5	45	8.69	3000	23.00	690000	561126	.813			
2					1390	69.48	1459.48		48	8.14	3200		736000	605684	.822			
3					1493	73.85	1566.85		52	7.52	3375		776250	650243	.838	.838	7.52	
4					1596	78.22	1674.22		55	7.10	3625		833750	594801	.833			
5					1699	82.59	1781.59		59	6.62	3875		891250	739360	.829			
6	2.75	3.00	3.60	1.00	1699	82.59	1781.59		46	8.50	3925	23.00	902750	739360	.819			
7					1802	86.96	1888.96		48	8.14	4125		948750	783918	.826			
8					1905	91.33	1996.33		51	7.66	4330		995900	828477	.832	.832	7.66	
9					2008	95.70	2103.70		55	7.10	4575		1052250	873035	.829			
10					2111	100.07	2211.07		58	6.74	4850		1115500	917594	.826			
11					2214	104.44	2318.44		60	6.51	5125		1178750	962153	.816			
12					2317	108.81	2425.81		63	6.20	5375		1236250	1006711	.814			
13	1.25	1.50	2.10	1.00	1390	69.48	1459.48	41.5	62	6.30	3400	21.50	731000	605684	.828			
14					1596	78.22	1674.22		71	5.50	3875		833125	694801	.834			
15					1699	82.59	1781.59		74	5.28	4100		881500	739360	.839	.839	5.28	
16					1802	86.96	1888.96		66	5.92	4350		935250	783918	.838			
17	0.75	1.00	1.60	1.25	1287	65.11	1352.11		66	5.92	3235	21.00	679350	561126	.826			
18					1390	69.48	1459.48		71	5.50	3450		724500	605684	.836	.836	5.50	
19					1493	73.85	1566.85		68	5.75	3725		782250	650243	.831			
20	0.50	0.75	1.35	1.25	1081	58.94	1139.94		73	5.35	2775	20.75	575812	473075	.821			
21					1184	60.74	1244.74		78	5.01	3000		622500	516567	.830			
22					1287	65.11	1352.11		84	4.65	3250		674376	561126	.832	.832	4.65	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

CHUTE, No. 1.—*Gate c. Pitch-back over-shot. Elbow-buckets. Close breast. Water let on at upper centre of wheel.*

No. of Expert.	Head of water above. Bttm. of gate.	Top of bkt.	Bttm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	1.00	2008	95.70	2103.70	41.5	69	5.66	4700	23.00	1081000	873035	.808			
2					2111	100.07	2211.07		73	5.35	4900		1127000	917594	.814	.814	5.35	
3					2214	104.44	2318.44		78	5.01	5210		1198300	962153	.803			
4	1.25	1.50	2.10	1.25	1287	65.11	1352.11	41.5	56	6.98	3200	21.50	688000	561126	.815			
5					1493	73.85	1566.85		63	6.20	3580		769700	650243	.845	.845	6.20	
6	1.25	1.50	2.10	1.50	1596	78.22	1674.22	41.5	57	6.86	3875	21.50	833125	694784	.831			
7					1699	82.59	1781.59		61	6.40	4125		886875	739360	.833			
8					1802	86.96	1888.96		64	6.10	4350		935250	783918	.838	.838	6.10	
9					1905	91.33	1996.33		68	5.75	4610		991150	828477	.836			
10	0.75	1.00	1.60	1.25	1390	69.48	1459.48	41.5	77	5.07	3440	21.00	722400	605684	.838			
11					1493	73.85	1566.85		82	4.77	3675		771750	650243	.842	.842	4.77	
12	0.75	1.00	1.60	1.50	1493	73.85	1566.85	41.5	73	5.35	3725	21.00	782250	650243	.831			
13					1596	78.22	1674.22		77	5.07	3935		826350	694801	.841	.841	5.07	
14					1699	82.59	1781.59		81	4.83	4200		882000	739360	.838			
15	0.50	0.75	1.35	1.50	1287	65.11	1352.11	41.5	77	5.07	3285	20.75	681637	561126	.822			Water too low on the gate to fill the buckets.
16					1390	69.48	1459.48		85	4.60	3510		728325	605684	.831	.831	4.60	
17					1493	73.85	1566.85		96	4.07	3825		793687	650243	.819			
18	2.75	3.00	3.60	1.00	1699	82.59	1781.59	41.5	59	6.62	3975	23.00	914250	739360	.809	.809	6.62	Air vents open.
19					1905	91.33	1996.33		67	5.84	4550		1046500	828477	.791			
20					2008	95.70	2103.70		72	5.43	4840		1113200	873035	.785			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Report of the result of experiments made at the United States Navy Yard, Washington City, in order to ascertain the relative strength of rope and chain cables.

THE subjoined report was handed to us by Mr. Judge, by whom the experiments were performed. The machine used for the trials was an excellent one, invented by Mr. Judge, and patented on the 29th of November, 1828. A notice of it will be found in the Journal, for February, 1829.

NAVY YARD, WASHINGTON, 26*th of April*, 1830.

SIR,—Agreeable to your order, I report the following as the results of experiments made in this yard, by order of the Commissioners of the Navy, for the purpose of ascertaining the relative strength of rope and chain cables. Each sample of hemp cable was ten fathoms long when first proved, and six fathoms at second proof. The circumferences were taken before stretched, and progressively until it became dangerous to touch them.

The 1st trial was made on the 10th of April, 1828; when I proved a $16\frac{3}{4}$ inch hemp cable, containing 1215 yarns, averaging $110\frac{3}{4}$ lbs., which stretched 11 feet, reduced $2\frac{1}{4}$ inches, and broke short in the middle with 392 lbs. in the scale; hanging on the index lever. This trial was made under the inspection of captain Stevens.

5th of August, 1829. Proved a 13 inch hemp cable, containing 855 yarns, averaging $114\frac{36}{100}$ lbs. which stretched 13 feet, reduced 2 inches, and broke with 175 lbs. in the scale.

6th of April, 1830. Proved an $11\frac{1}{4}$ inch hemp cable, containing 554 yarns, averaging $124\frac{26}{62}$ lbs. stretched 9 feet, and reduced $1\frac{7}{8}$ inch, when it broke within the splice, with 156 lbs. in the scale; it was spliced and attached to a chain of $1\frac{7}{8}$ inch wire, delivered by Penfield and Taft, when the rope broke in the splice with $190\frac{1}{2}$ lbs.

Proved a 15 inch cable containing 901 yarns, averaging $120\frac{87}{100}$ lbs. stretched 12 feet, reduced 3 inches, and broke abreast of the splice with 227 lbs. in the scale; reconnected to a $1\frac{1}{8}$ chain, made of Peru iron, when the chain broke with 284 lbs. (this link was very short grained;) reconnected the same rope and a $1\frac{7}{8}$ chain of Peru iron, when the rope broke with 336 lbs. in the scale.

Proved a $16\frac{3}{4}$ inch cable, containing 1203 yarns, averaging $142\frac{37}{133}$ lbs. (made by Herron of Norfolk,) which stretched 10 feet 8 inches, reduced $2\frac{1}{4}$ inches, and broke abreast of the splice with 435 lbs.; reconnected to a chain $1\frac{7}{8}$ inch wire, Peru, which broke with 270 lbs. with one strand of the cable; replaced it with a new link, and spliced the cable, it being reconnected, the new link broke with 248 lbs.; then attached the cable to an $1\frac{7}{8}$ chain, when the cable broke with 452 lbs. in the scale.

Proved a $17\frac{3}{4}$ inch hemp cable, containing 1514 yarns, averaging $120\frac{4}{16}\frac{1}{8}$ lbs., stretched 9 feet 8 inches, reduced $1\frac{3}{4}$ inch, and broke clear of the nip with 389 lbs.; spliced and connected to a piece of $1\frac{1}{4}$

chain, of Peru iron, when the rope broke abreast of the splice with 418 lbs. in the scale; the chain was much injured, showing the rope and chain nearly of equal strength.

Proved a $20\frac{3}{4}$ inch cable, containing 1825 yarns, averaging $120\frac{45}{203}$ lbs., stretched 11 feet 10 inches, reduced $2\frac{3}{4}$ inches, and broke short about 7 feet from the splice with 550 lbs.; it was again spliced and attached to Penfield and Tafts $1\frac{9}{16}$ chain, and a piece of Peru chain of $1\frac{1}{2}$ wire, when the rope broke close to the splice with 481 lbs. in the scale.

Proved a 22 inch cable, containing 2236 yarns, averaging $111\frac{213}{230}$ lbs., stretched 14 feet, and reduced $3\frac{1}{4}$ inches. This cable had several trials, in consequence of which it may be thought proper to add 10 lbs. to the greatest weight it bore, which will make the strength of the cable equal to 661 lbs. in the scale, (as will appear by the following statement:)

At the 1st trial, a rivet in the proving chain broke with 553 lbs.; connected, when another rivet broke with 561 lbs. 3d trial, three rivets broke with 651 lbs. I then had the holes reamed and larger rivets substituted, when the cable broke with 557 lbs. which shows that the rope was nearly gone when it raised 651 lbs.

Having respliced the same cable to 6 fathoms, and connected it to a piece of Peru chain of $1\frac{7}{8}$ wire, and a piece of Penfield and Taft's of $1\frac{5}{8}$ wire, the rope broke in the middle between both splices with 437 lbs. in the scale.

Proved a $25\frac{3}{4}$ inch hemp cable, containing 2849 yarns, averaging $124\frac{147}{320}$ lbs., which stretched 11 feet 10 inches, reduced $2\frac{3}{4}$ inches, and broke with 642 lbs. in the scale. This cable was attached to a piece of $1\frac{7}{8}$ inch chain Peru iron, a piece of $1\frac{9}{16}$ Penfield and Taft's, a piece of $1\frac{3}{4}$ English, and a piece of $1\frac{7}{8}$ Ridgly's, with links and shackles from the latter, of 2 to $2\frac{1}{4}$ inches, which broke in the following order:

1st. trial a shackle of Ridgley's broke with	499 lbs.
2nd. do. a 2 inch connecting link do. do. do.	553 do.
3d. do. a $2\frac{1}{8}$ inch shackle of do. do. do.	566 do.
Do. do. Penfield & Taft's cracked, not parted do.	566 do.
4th. do. a shackle of Ridgley's do.	535 do.
5th. do. Penfield & Taft's do.	539 do.
6th. do. a shackle of $2\frac{1}{4}$, Ridgley's	473 do.
7th. do. a Peru link of $1\frac{7}{8}$ inch	642 do.
8th. do. the rope broke clear of the splice with one strand at the other end,	571 do.

This cable having so many shocks, and the injury received by the recoil each time the chains broke, it is supposed that adding 52 lbs. to the weight raised at the 7th trial, would have broken it at that time, making the strength of the cable equal to 694 lbs. in the scale.

In conclusion of this report, I would beg leave to suggest the propriety of having the chain cables made larger, as the sizes now made are much smaller than are used by any other nation, for the same classes of vessels. By increasing the size there would be no loss by the chains already made; as the $1\frac{7}{8}$ inch chains intended for 74's are

but the common size for 44's, those for 44's being transferred to 36's, and so on in rotation.

There is another object worthy of consideration, though seemingly trifling still of great importance: In ordering chain iron there is no allowance made for wastage, as the iron when delivered, is but the neat size or what the chain should be when finished; which renders it necessary that the iron should be ordered $\frac{1}{16}$ of an inch larger than the intended sizes of the chains.

A sheet of iron $\frac{1}{32}$ of an inch thick, and $6\frac{1}{4}$ inches wide, will require 15,625 lbs. to tear it asunder, (agreeable to the statements of several authors,) it will therefore be perceived that a $\frac{1}{16}$ loss in the diameter of a chain is of great importance.

Respectfully yours, &c.

(Signed,) JOHN JUDGE.

COMMODORE ISAAC HULL.

I respectfully submit for your consideration the following table of proportions for hemp and chain cables, and the sizes of iron before made into chains.

Circumference of rope in inches.	Diameter of chain in inches.	Size of iron before made into chains.
$10\frac{1}{2}$	1	$1\frac{1}{16}$
11	$1\frac{1}{16}$	$1\frac{1}{8}$
12	$1\frac{1}{8}$	$1\frac{3}{16}$
13	$1\frac{3}{16}$	$1\frac{5}{16}$
14	$1\frac{5}{16}$	$1\frac{3}{8}$
15	$1\frac{3}{8}$	$1\frac{7}{16}$
16	$1\frac{7}{16}$	$1\frac{9}{16}$
17	$1\frac{5}{8}$	$1\frac{11}{16}$
18	$1\frac{11}{16}$	$1\frac{3}{4}$
19	$1\frac{3}{4}$	$1\frac{13}{16}$
20	$1\frac{13}{16}$	$1\frac{7}{8}$
21	$1\frac{7}{8}$	$1\frac{15}{16}$
22	$1\frac{15}{16}$	2
23	2	$2\frac{1}{16}$
24	$2\frac{1}{16}$	$2\frac{1}{8}$

Respectfully yours, &c.

(Signed,) J. J.

COMMODORE ISAAC HULL.

On the Rapid Movement of Boats on Canals.

A WORK has recently appeared in London entitled "Remarks on Canal Navigation, illustrative of the advantages of the use of steam as a moving power on canals. By William Fairbairn, Engineer;" which details several experiments made on the Forth and Clyde, Union, Markland, and Androsson canals, manifesting that a high degree of speed may be attained in the navigation of canal boats, without injury to the banks. Some notices upon these subjects have appeared in the public papers, and extracts have been made from the

work in a recent report of the Managers of the Chesapeake and Ohio Canal Company, which are well calculated to arrest the public attention. The subject is rendered particularly interesting at a period when the battle has waxed warm between the advocates of rail-roads and of canals; and should it appear, as the experiments alluded to tend to prove, that boats moving at the rate of ten or twelve miles an hour, produce less agitation in the water, and consequently less injury to the banks than with only a half or one-third of this velocity, an important point will be gained by the friends of canals; we think it improbable that a greater degree of speed than this upon rail roads, although a much greater has been attained, will not be found eligible. "The Ardrossan canal is throughout very narrow; at the bridges and many other places it is only nine feet broad. It has a great number of turns, and many of them are very sudden." On this canal a velocity of twelve miles an hour has been attained by a boat in which there was a steersman and eight other persons; "the boat accomplished a distance of two miles, with one horse, in ten minutes, without any surge, or agitation of the water injurious to the banks."

The summary of the results from the first experiments on the Forth and Clyde canal, embraced three objects worthy of particular notice, as this author very justly affirms: "First, the ease with which the boats were brought up, or stopped, when moving at a high rate of velocity; secondly, the little additional labour, in drawing, occasioned to the horse, when drawing the boat at this high rate, as compared with a low rate of velocity; and thirdly, the apparent diminution of the surge, or agitation in the water, at a high rate of velocity."

Since these experiments, a boat has been regularly "plying between Glasgow, Paisley, and Johnston, on the Ardrossan canal," and carrying "from forty to fifty passengers, at the rate of from nine to ten miles an hour."

The following experiments were made on the Forth and Clyde canal.

"On Wednesday, the 7th of July, the Swift, a boat 60 feet long and 8 feet 6 inches broad, twin-built, and fitted to carry from fifty to sixty passengers, started from Port Dundas, at 16 minutes past 9 in the morning, having on board thirty-three passengers, (all men,) and their baggage. Proceeding through the Forth and Clyde, and Union Canals, she reached Edinburgh at 29 minutes past 4 in the afternoon. She thus made a voyage of 56 miles and a half in the space of 7 hours and 14 minutes. In the course of this voyage, she passed through fifteen locks, eighteen draw-bridges, a tunnel 750 yards long, and over three long narrow aqueducts, and under sixty common bridges, which carry roads over the Union Canal. Her average rate of speed, during the voyage, was nearly eight miles per hour, including every stoppage.

"On the following day, Thursday the 8th of July, the Swift started from Edinburgh, 22 minutes past 9, in the morning, and returning by the same route, with 33 passengers, (all men,) and luggage, she reached Glasgow precisely at 4 o'clock in the afternoon—that is, in 6 hours 38 minutes; going thus at the rate of nearly 9 miles per hour." "On both days the weather was most unfavourable, from

much rain, and a strong gale of wind, directly in her face, having been from the east on Wednesday, and from the west on Thursday."

"When free from the locks, tunnel, and other impediments, the speed at which she proceeded varied from 6 to 12 miles an hour; and the extraordinary results of the previous experiments made on the Paisley canal, and Forth and Clyde canal, were again completely verified and ascertained during her progress through 113 miles of canal navigation. For it appeared that when she moved through the water at the rate of 6 or 7 miles per hour, there was a great swell or wave constantly in her front, and she was followed by a strong surge or wave, bearing against the bank of the canal. At these times the hauling rope was tight, and the horses appeared to be distressed. But as the speed was increased, the wave or swelling of water in her front sunk down; and when the speed came to be about 9 miles an hour, the swell entirely disappeared, the waters in front became smooth and level; the hauling rope slackened, and the horses seemed easy, and little or no surge was to be seen on the banks behind the vessel."

On these experiments, the following comment is made by the same writer: "There appears, therefore, no reason to fear, that the banks of canals can ever be hurt, by increasing the speed of boats, to the utmost attainable height; and measures are in progress for increasing the speed of passage boats on the Forth and Clyde canal, and the Union canal; or at least of keeping it, during the whole voyage, between Glasgow and Edinburgh, to the highest rate, which has been already realized; and thus, reducing the time consumed in the voyage, to five hours."

To these experiments, Mr. Fairbairn has added many others which are referred to in the text, and more minutely described in the appendix of his very interesting work; and from them he deduces results confounding all the established theories "that the resistance, to a body, drawn along a line of water confined within the banks of a canal, did not appear to increase in the ratio, laid down in theory; and that, while at a low rate of velocity, viz: at, and under 6 miles an hour, the resistance to the progress of the boat, on a broad line of water, was considerably less than on a narrow line; on the contrary, at a high rate of velocity, say above ten miles an hour, the forces necessary to the propulsion of the boat, on a broad, and narrow line of water, appeared to be the same if the advantage was not rather in favour of the narrow line."

From these observations he was induced "to recommend, and the Forth and Clyde canal company to agree, to build a light twin iron steam passage-boat, to ply between Glasgow and Edinburgh," which, at the date of his publication, he was preparing to launch. "Her length is to be 68 feet, her breadth of beam 11½ feet, her steam engine to be of 10 horse power; the diameter of her paddle wheel 9 feet;" "and its motion calculated to give from 50 to 60 strokes in the minute; her whole weight 7 tons 16 cwt. and her draft of water 16 inches. She will accommodate from 100 to 150 passengers; her anticipated velocity will be from 9 to 10 miles an hour, and the cost

to the canal company, for the conveyance of a passenger, between Edinburgh and Glasgow, 56 miles, will not much exceed 2 pence; which," Mr. Fairbairn adds, "is not a fifteenth of the expense of the conveyance of the same person, at the same rate, supposing it attainable and maintainable by horses."

Mr. Fairbairn says, "that however much he was persuaded that steam power was the cheapest for high velocities, and also for propelling vessels in canals, where the trade was regular, I was not till lately prepared to consider a steam boat, on a canal, as the cheapest, for the conveyance of goods where the trade was irregular, and where the boat had not only to contain a cargo, but at the same time to carry her own engine, and all the conveniences necessary for the application of machinery."

But he proceeds—"Mr. Grahame has lately put into my hands a letter on this subject, addressed to a shipping company, carrying goods along a line of canal 56 miles in length; the calculations contained in that communication are given in the Appendix, and seem to be decisive in favour of steam power. The company, to which this letter is addressed, have to pay for a quantity of horse power, sufficient to deliver 40 tons of goods at each extremity of this line, of 56 miles, every day in the year; besides a spare power employed chiefly in one particular branch of their trade.

The sum they paid for each delivery is one guinea, each way, or at a rate of about one-ninth of a penny per ton, per mile, for the trackage of the goods conveyed. The company, in question, supplying the tracking lines, but, with this addition, the charge for trackage is not increased to one-eighth of a penny per ton, per mile.

"This," says Mr. Fairbairn, "is certainly a small sum whereon to effect a saving by a change of power; but, nevertheless, it appears (from Mr. Grahame's and my own calculations) that not only such saving may be effected, but an additional saving of a large portion of time can be made, by the change from horse to steam power.

"The calculations here referred to make it quite unnecessary," adds the writer, "to say any thing on the subject of *steam power*, as a substitute for trackage, on canals. If *it* be so much cheaper than horses, in the expensive shape of a moving and carrying power, *united in the same boat*, what advantages may not all canals derive from its introduction, in the cheap form of a tug boat, in place of horses?"

In his Appendix, the author adds, "I am the more convinced of the efficacy of steam trackage, above all others, from the circumstance that the train of boats intended to be towed would follow in each other's wake; as the eddy formed by the leading vessel materially lessens the resistance opposed to the succeeding boats." "The small amount of power required to tow a vessel, was remarked by Mr. Grahame in his account of the voyage of the Cyclops, from Alloa to Port Dundas:" "he states, 'when we brought her into the canal, we attached her to the passage boat, and she drew her along the canal 2 miles—1 mile in 14, and the other in 15 minutes. We

then detached her from the passage boat, and did two other miles, but could not save, by this decrease of labour, more than a minute, or a minute and a few seconds, in each mile.' One thing is very evident," says Mr. Fairbairn, "that the introduction of steam, instead of animal power, would dispense with the annual repairs and maintenance of the horse paths; the complaints and delays arising from drivers, horses, &c. would be avoided, and many contingent expenses saved by the introduction of this never failing and very effective agent, as a moving power for the towage of boats on canals."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks upon Bent Axles and Dished Wheels, in reply to the observations of Mr. J. S. Fry, *of Bristol, England. Published in the Journal of the Institute for May last. Page* 358.

To the Editor: Sir,—If I understand the meaning of Mr. Fry, it appears to me that the positions he has taken are erroneous. He seems to assume that wheels are conical on the face or tread, because they are dished in the spokes, that is, because the spokes are set at an angle with a plane, perpendicular to the hub. This, I conceive, does not follow, and however the construction of wheels may be in England, I am greatly mistaken, if the felloes and tire of all carriage wheels in America are not as truly cylindrical as they can be made, and that no such grinding, as he mentions, takes place in this country.

Where roads are paved, or covered, as they mostly are in England, and present laterally a nearly level surface, it may be less necessary to dish carriage wheels—but, in all countries, where wheels are subject to much side thrust, dishing of wheels outwardly, appears to be absolutely necessary: for, if I understand the subject rightly, in that form consists much of the ability of the structure to sustain the lateral pressure which is always applied to those wheels toward which the load inclines, in proportion as the vehicle is jostled, or conveyed over a side-long track. The spokes being set dishing or conical, they cannot be forced into a circular plane, without bursting the tire, if it be well applied to a well constructed frame. In this, I see no reason for supposing that the tread of the wheel is not perfectly cylindical, as I believe they are, and that they produce no such grinding, or tendency to roll out of a straight line, as the author supposes.

He further says, "it appearing then that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down.*" He seems to argue, that as cones incline to roll only in circles, that tapering and bent axles incline in the same way, even when the boxes are in like manner conical. If this be his position, I think it an erroneous one. I conceive, of a tapering axle divided into an infinite number

of rings or frustums, and the box or boxes divided into rings or frustums, corresponding to those in the axle, there can be no tendency conceived of, that will cause any part of the axle to encroach upon that part of the box, assigned to any other division. Although rolling cones incline to circles, turning cones have no such tendency that can be conceived of. Hence then it appears that there is no disadvantage, such as he conceives, resulting from the tapering or conical shape of the axle. I now propose to show that it is necessary.

A determinate size of wood or metal is necessary to be assumed in the axle, not only to bear the load intended to be placed upon it, but as the hubs seldom equal in length the radii of the wheels, the side thrust of the vehicle must operate to break the axle at the shoulder, in a correspondingly greater proportion, by the leverage thus acting upon the strength of the axle. The necessary size of the axle at the shoulder being assumed, and as the whole stress of side thrusts being applied at the shoulder, all the size intended to resist that stress may be safely dispensed with at the linch-pin, or point of the axle, where neither the weight nor thrusts act under circumstances to break the axle, the strength of the hub preventing such an occurrence, where the axle and hub correspond throughout. From the principles of wheels and axles, I argue, that it requires less force to overcome the friction of the box upon the axle, where the box and axle are small, than where they are large. Hence, I conclude, that as there is no disadvantage in tapering the axle, it is proper to do so, in order to avail ourselves of this circumstance.

Next and lastly, the bent axle. As wheels are dished, this is necessary, to bring the lower spokes nearly, or quite perpendicular under the weight, and as the axle is pointed, it is necessary to give all the cone shape, or slant to the axle on the upper side, in effect to bend it, in order that the weight of the load may not rest on an inclined plane, which would cause the wheel to press against the linch-pin. As Mr. Fry did not argue this point, I conclude that he conceives a straight axle a necessary feature of a cylindrical one. An axle bent downwards, as is the mode of making them, throws perfectly cylindrical tire upon the outer corner, on a road precisely flat; but upon a convex road, the result is a fairer tread than any cylindrical wheel can have with a straight axle. In neither case is there any tendency imparted to the wheel, to move in other than a straight line. If the handles of a wheelbarrow be held as near the road as the axle, and one raised and the other depressed, the effect will be precisely that of a bent axle; but no tendency will be found in the wheel to move out of a straight line. But if the handles be held further from the road than the axle of the wheel, and the barrow inclined in the same way, the effect will be to change the direction of the track. The reasons appear plain. In the first instance, the axle maintains a direction perpendicular, or directly across the track; but in the last instance, the elevation of the handles occasions the inclination of the vehicle to throw the axle not only out of its level position, but out of its straight direction.

I conclude, that axles bent backwards, incline wheels outward, so when the axles are bent forwards, the wheel will incline inwards. Were axles constructed in this way in a small degree, that is, tapered a little more behind than before, they would rarely run off, even were no nut nor linch-pin used; but this would incline the wheel to grind, as complained of by Mr. Fry, in the same small proportion. Axles, however, bent directly upward or downward, I conceive to have no such tendency from rolling merely.

I am not about to enter upon a disputation with Mr. Fry or any other person. I hope, however, to elicit the remarks of those who have a greater share of scientific and practical knowledge of the subject than myself. Respectfully,

JNO. S. WILLIAMS.

Washington, Mason county, Ky., June 12th, 1831.

Description of EBENEZER A. LESTER'S *Pendulum Steam Engine.*

WE have been furnished by Mr. Lester, of Boston, with impressions from the engraving of his pendulum steam engine, together with a pamphlet containing his views upon the subject, and the testimonials of its satisfactory performance from those who have had the instrument in use. From this pamphlet we shall make such extracts as may appear to us sufficient to give a clear idea of the whole, accompanied with such remarks as may suggest themselves in relation to it. If in so doing we dissent from Mr. Lester in some of his theoretical opinions, we wish it to be most distinctly remembered that these differences of opinion have nothing whatever to do with the goodness of his engine; this is a question of practice entirely, the engine has been in use for a considerable length of time, and has given entire satisfaction to those who are well able to form a correct judgment respecting it, and who have no interest to promote but that of truth.

Mr. Lester does not lay claim to the invention of the vibrating cylinder engine, but only to that modification of it which he describes under the name of the pendulum engine. He observes that "In the application of steam power by machinery, it has been the object of all inventors, from the time of Watt to the present, to direct the power of the steam, in the first place, to the production of a rotary motion, and thence to take the motion adapted to produce the effect intended. The material question then, in regard to any plan of a steam engine, is, whether it is well calculated to produce a rotary motion, and that is the best, which gives such a motion in the most direct and simple manner. The pendulum engine is proposed as possessing very important advantages in all the particulars above mentioned."

In a note appended to this paragraph, he makes the subjoined observations respecting the principle upon which the power of steam engines is sometimes estimated, and on the relationship which exists between the boiler and the engine.

"In relation to steam engines, about which so much has of late been said and written, I will here make a suggestion respecting the estimate of the *power* of an engine, in regard to which, there is a great deal of obscurity, and uncertainty, both in contracts and in speculations on the subject. In estimating the power of an engine, for instance, as being equal to that of a certain number of horses, only the diameter of the cylinder and length of the stroke are sometimes given, without taking into consideration, the force of the steam and rapidity of motion, with which the engine is calculated to operate; for it is apparent that doubling the rapidity of the motion of the piston, with the same force of steam to the inch constantly acting upon it, will double the power of the engine, as much as doubling the surface of the piston on which the steam acts, supposing it still to act with the same force upon the square inch. It is evident that the largest cylinder, without an adequate supply of steam, will not make a powerful engine; and on the other hand, that a comparatively small cylinder, with a high pressure of steam, and running with great velocity, would make a powerful one. In estimates of this sort, we must, therefore, take into consideration the extent of the surface of the piston on which the steam acts, the degree of pressure of the steam to the square inch, and the rapidity of the motion of the piston.

"It is a popular error, also, not to distinguish sufficiently, the engine from the boiler, or generator, which is, in fact, as distinct from the engine, as the strength of the mechanic is from the tool with which he works. It may, therefore, not be superfluous to apprize persons, not conversant with steam enginery, that the remarks made above, on the pendulum engine, apply to the engine as distinct from the boiler or generator."

That the errors above alluded to have appeared in the estimates and calculations of individuals is indisputable, but we are not aware that they have prevailed to any extent, nor do we perceive how it is possible that they should do so excepting in the minds of those whose acquaintance with the steam engine is extremely limited. We have always considered the area of the piston, the length of the stroke, the number of strokes per minute, and the elastic force of the steam, as the necessary and usual elements in estimating the power of an engine; and although much which has appeared upon the subject has been very loosely written, the published investigations which embrace it in all its bearings are voluminous. The boiler, or generator, is the very soul, the animating principle, of the steam engine. All the *essential* difference in principle between the low and high pressure engines resides in the boiler, and provided the parts of the engine have sufficient strength, all that is necessary to convert the low into the high pressure engine, is to neglect the condenser, and to increase the fire, so that steam of a higher temperature and greater density may be produced in a given time.

Many of the subsequent observations made by Mr. Lester apply to the vibrating cylinder engine in general, whilst others are more particularly appropriate to his modification of it. The vibrating cylinder has been generally suspended upon trunnions, at or near its

middle; the cylinder has also been placed both vertically and horizontally. The peculiar feature of Mr. Lester's engine is the placing of the trunnions upon which it is suspended, and through which the steam is supplied, at the upper end of the cylinder, in order to give it a tendency to vibrate as a pendulum, from which circumstance its name has been derived. Mr. Lester observes, that "One advantage of the pendulum engine is obvious, not only to a mechanic, but to any person not at all skilled in mechanics, on the first inspection of the engine, or even a print of one, namely, the application of the power by connecting the piston rod *immediately* with the crank pin. Here the lever beam, connecting rod, and all the gearing and apparatus of whatever kind, interposed between the piston rod and crank pin, in fixed engines of all descriptions, is at once dispensed with. The cost of maintaining this gearing is thus avoided. This part of the machinery, in fixed engines, is, as every practical engineer well knows, very liable to get out of order, and the engine must occasionally be stopped to repair it. This inconvenience is also saved by the pendulum engine. And then, this gearing or intermediate machinery, in some fixed engines, as, for instance, an engine standing on end, and working upwards by a connecting rod, constantly opposes the motion of the crank, by its gravity, except at the dead points, when the connecting rod is precisely perpendicular. The resistance from this cause is not great, but whatever it may be, it is saved in the pendulum engine. Again, this intermediate gearing is liable to friction, which is a constant impediment that must be overcome by a constant expenditure of power for this purpose. The pendulum engine avoids this impediment. By considering how much power would be requisite to keep this intermediate gearing and machinery of a fixed engine in motion, precisely as it moves when the engine is in operation, some estimate may be formed of the saving of power, made in this particular, by the pendulum engine. This single advantage of that engine, unless it is offset by some important disadvantage, will, the inventor apprehends, be a sufficient ground for a decided preference of it. But it has other advantages which are conceived to be of much greater importance."

In producing a rotary motion from the piston rod of a fixed cylinder, the action of the rod, excepting at the dead points of the crank, is never direct, the bar which connects the piston rod with the crank, always tends therefore to force the piston rod laterally; to prevent this effect, slides, or parallel rods, are provided, upon which a portion of the power is expended. Power is consequently lost both from the angular action upon the crank, and the friction arising from the lateral pressure. "When the connecting rod is three times the length of the crank, (which has been considered by machinists a safe proportion of these parts,) the saving of power, made merely by its direct application in the pendulum engine, is 16 2-3 per cent. When a longer connecting rod is used for the fixed engine, the difference will be less. The connecting rod and crank are, however, very frequently about in the above proportion in fixed engines. This saving is a matter of demonstration by the easy and ordinary process of the

resolution of a force, indirectly applied, into the two parts—that which is lost, and that which takes effect. For this superiority of the pendulum engine, therefore, I have only to refer to lines and figures, and a familiar principle in mechanics."

With a fixed cylinder, if the cylinder itself, the stuffing box through which it passes, and its connexion with the slide, or beam, do not all perfectly coincide, there is, consequently, a continued tendency to bend or break the piston rod; and where the strength is such as to resist this, there is yet a great wear of the rubbing parts, and a considerable loss of power. The pendulum engine being to a considerable extent exempt from this lateral pressure, appears by the certificates given, to require packing only one-fourth as often as the ordinary fixed engine.

The tendency of the pendulum engine to a vibratory motion, the inventor states, gives to it a manifest superiority over the ordinary vibrating cylinder, hung upon its centre; the whole tendency of the latter, when put into motion, being to a continuance of it in a circle; whilst the former, obeying the law of gravitation, always tends to a vibratory motion. Mr. Lester, in his description, enters into some estimates founded upon the length of the pendulum which vibrates seconds, (39⅛ inches,) and that of a pendulous cylinder which should vibrate in the same time, intended to exhibit the advantages resulting from this structure. His calculations upon this point are necessarily somewhat vague, as, from the attending circumstances, they do not, in fact, admit of any thing like precision; he observes that "In regard to gravity, the cylinder of the pendulum engine will represent a pendulum of a little less than two-thirds of the length of the cylinder of the engine, so that a pendulum engine, of which the cylinder is four and a half feet in length, will, as far as gravity and oscillation are concerned, represent a pendulum of 30 to 36 inches in length. As such a pendulum vibrates seconds, it follows that an engine of which the cylinder is four feet and a half in length, will perform 30 to 35 revolutions in a minute, without the least disturbance or impediment from its gravity; and an engine, of which the cylinder is twenty-seven inches in length, will perform somewhere about 50 or 60 revolutions a minute, without any obstruction from this cause. To this degree there can be no question that gravity concurs perfectly with the motion of the cylinder of the pendulum engine. But it appears from the facts stated in relation to the engines already in operation, that it may be run at double this velocity at least, to advantage. The engineer of the pendulum engine at the Navy Yard in Charlestown, from observing the action of the engine, estimates that it might be advantageously driven a hundred revolutions a minute. This allows of a greater velocity than that at which a fixed engine can be driven without endangering its gearing."

The difference between a pendulum of 30 inches, and one of 39⅛ inches, is too great to admit of the conclusion that they each vibrate seconds. We speak of this only as a matter of calculation which does not do much towards establishing the point insisted upon; and indeed it is admitted both by Mr. Lester and those who have used

his engine, that the rapidity of its action may vary greatly from that of its natural vibration, without any apparent inconvenience; and such we should have anticipated would prove to be the case. Were the fact otherwise, we should view it as a serious disadvantage, as the number of vibrations made in a given time, cannot, in the working of a steam engine, be rendered uniform under the varying circumstances of its application.

"Another advantage in the plan and construction of this engine, remaining to be mentioned, arises from its working in a frame, the parts of which always maintain the same relation to each other, and, as it has in its operation no tendency to displace any fixtures or disturb the foundation, a great expense is saved in these respects, in putting up the engine, more especially in places where it is difficult to get a good foundation. The pendulum engine only requires a foundation sufficient merely to support the *weight*, without any necessity of providing for extraneous resistance to the action of the machine itself, as in the case of a fixed engine."

"On this engine being first put into operation, a query was suggested whether it would have a greater tendency, than a fixed engine, to wear the cylinder ovaling or untrue. I felt great confidence from the first that it would not prove to be liable to this objection, and experience has fully shown, as will appear from the certificates annexed, that with any reasonable skill and care in keeping it packed, it will wear perfectly true, which is not always the case with fixed engines, even with the greatest attention of the engineer. So far, therefore, from there being any objection to it in this respect, it might be enumerated as one of its advantages, that it is less liable to wear the cylinder unequally, than a fixed engine; though there is no doubt that an engine, on this, or any other plan, may wear the cylinder unequally in case of gross negligence in keeping it packed."

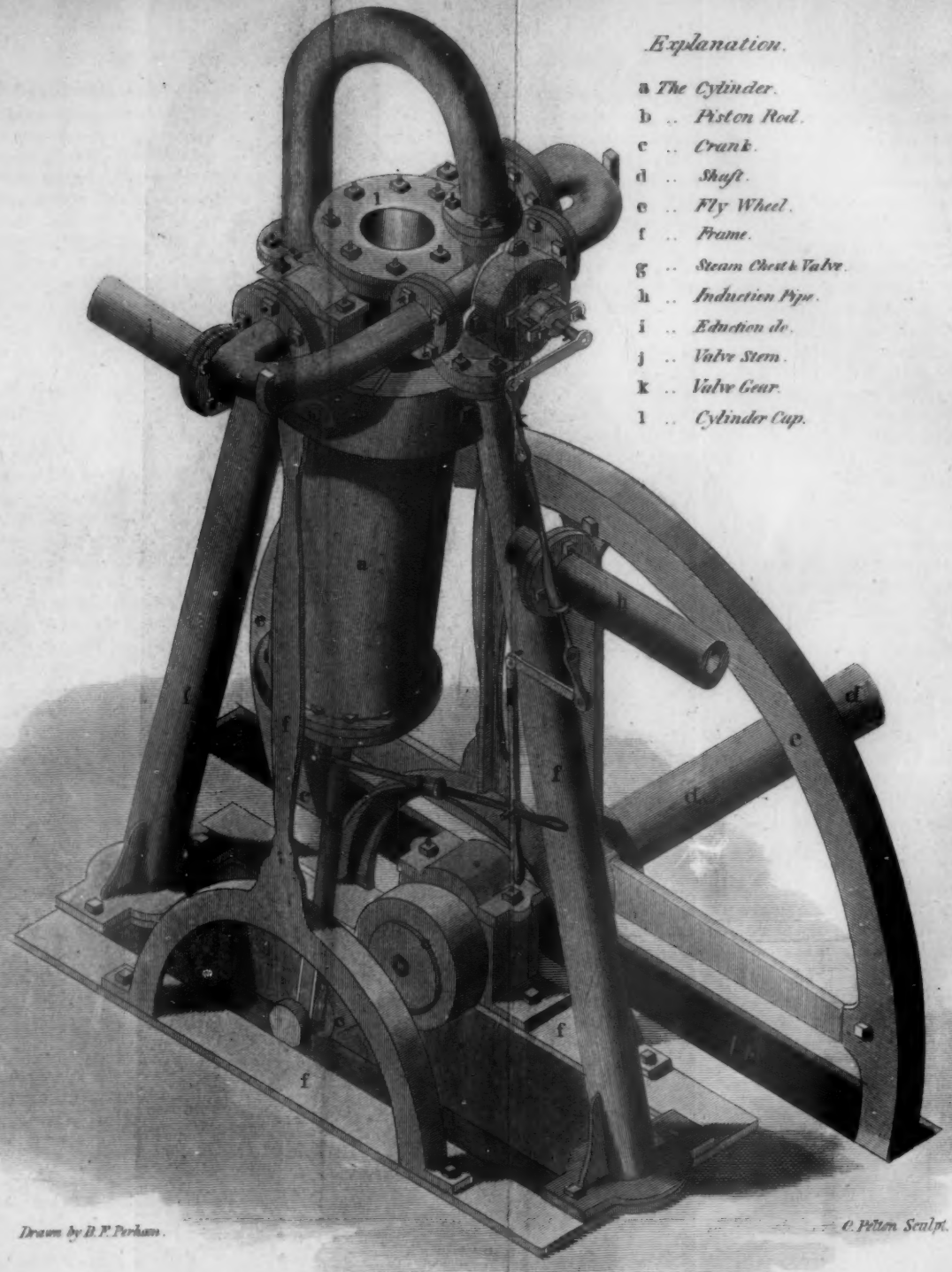
"As practical application and use are the true tests of all machinery, I have requested some persons who have been acquainted with the operation of this engine, to make statements of the results of their experience and observation. Their statements are annexed. They are made by persons who have no interest whatever in obtaining for the machine a better reputation than it merits. Some of them are persons of mechanical science, others are practical engineers; and a number of them are sufficiently well known to the public, to insure confidence in their statements and opinions."

We cannot insert the whole of the certificates in consequence of their great length; we therefore make an abstract from them, containing what relates particularly to the action of the engine.

CERTIFICATES.

NOAH BUTTS, Engineer of the Navy Yard, Charlestown, states that one of Mr. Lester's engines had been used by him for two years; that he had found it greatly superior to those on the old plan; requiring packing much less frequently, and keeping in order much longer. That it had no tendency to wear oval. The engine has a nine inch cylinder, and a twenty-eight inch stroke. It has run about 16 hours

LESTER'S PENDULUM STEAM ENGINE



per day; at times it has worked six pumps and driven four lathes for turning iron, &c. and two grind stones. Two of the pumps lift a column of about forty feet each, weighing about a ton. The four smaller lift 16 feet, the column of each weiging about 200 lbs. The stroke of the large pumps about 33 inches; those of the smaller 24. The strokes of the pump as compared with those of the engine, are as 7 to 25. The boiler is 18 feet long, and 3 in diameter. The usual pressure from 20 to 30 lbs. per inch.

L. BALDWIN, Esq. Engineer of the Dry Dock, Charlestown Navy Yard, says:—"The engine was first set to work in May, 1828, and has ever since been daily used in pumping water from the foundation of the dock. No part of the machinery has given way, nor has the engine failed to do all the work which was required. It has, in every respect, answered my expectation, and were I to engage in a similar undertaking, I would obtain a similar engine for the same service. Its simplicity and compactness render it peculiarly adapted to constructions like the dock, where a slight and temporary foundation only can be had. I have always viewed its operation with peculiar pleasure, and am convinced that it has been more economical than any other engine of the same power I could have procured. I regret I had not procured one like it for draining the works of the Norfolk Dock in Virginia.

ALEXANDER PARIS, Superintendent of the Dry Dock, certifies to the facts before stated, and to the general excellence of the engine; and a similar certificate is given by eight other persons employed there.

From the Woollen Manufactury of BENJAMIN BUSSEY, Esq., in Dedham, there are several testimonials of its goodness. After a long and fair trial its parts were all in excellent order, and it did not require packing more than three or four times a year.

"*Extract of a letter from the Rev. Enoch Burt, of Manchester, Conn. dated June* 11, 1830.

It is now six months since I have had your pendulum engine in operation. It works well. From a practical as well as scientific acquaintance with the various engines now in use, I, at the first examination, (viz. at the Dry Dock in Charlestown,) pronounced it in my own mind vastly superior to any other plan, and from operating it for six months, (during which time it has never been repacked,) in my manufactory, I am fully confirmed in my opinion of its superiority; it is, you know, only a four and a half inch calibre, 18 inches stroke, and I run it but 35 revolutions per minute: (it would be adviseable to run it much quicker, but this speed is best for my work,) and with steam at about 25 lbs. per inch, it drives my fulling mill, calender, shearing and drying machines, and raises the water for the works by a pump of 4 inch calibre and 9 inches stroke, from a

well 25 feet deep. I have run it three days with one cord of 2 feet wood, (oak,) which is sufficient. The simplicity of it is admirable. It exhibits all its parts in operation at a single view. I have no trouble in keeping it tight and in order—and I do not hesitate to say that it will, with a given quantity of steam, produce an effect 20 per cent. greater than can be produced in one of the same size stationary cylinder. This arises from the great diminution of friction, by the direct application of the power to the crank. It runs perfectly smooth—no noise—and with proper attention no way liable to get out of order. Those who want steam power, need only make themselves acquainted with the pendulum engine to give it at once a decided preference to every other kind now in use—for it only wants to be known to be preferred, and this is the engine that is fitted, from its construction, (and the only one,) for rail-roads. I need not wish you great success in introducing it; the intrinsic excellency of the invention must insure it. If my opinion is of any service to you in forwarding its introduction, you are at liberty to make what use of it you think proper.

Yours, &c.

E. Burt."

Mr. E. A. Lester.

The accompanying plate, with the references thereto, exhibit with sufficient clearness, the general structure and arrangement of the engines.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, June 23, 1831.

Mr. Samuel V. Merrick was appointed chairman, *P. T.* and Mr. Frederick Fraley, Recording Secretary, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Howell Hopkins, Esq.

The Gentleman and Cabinet Maker's Director, being a collection of the most elegant and useful designs of Household Furniture, 1762.

By Messrs. Carey & Lea.

The nature and properties of the Sugar Cane, with practical directions for the improvement of its culture, and the manufacture of its products, by G. R. Porter.

By Messrs. G. & C. & H. Carvill, New York.

Treatise on the Steam Engine, by James Renwick, LL. D.

A Compendium of Mechanics; or a Text Book for Engineers, Millwrights, &c. by Robert Brunton, with additions by James Renwick, LL. D.

By Mr. R. S. Gilbert.

The Cabinet of Natural History and American Rural Sports, No. 6, *vol.* 1*st.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for May, 1831.

The Repertory of Patent Inventions, for May.

The Mechanics' Magazine, for April.

The Register of Arts and Journal of Patent Inventions, for May.

The Journal of the Royal Institution of Great Britain, for May.

Recueil Industriel, for January.

Bibliothéque Physico-economique, for March.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for December, 1831.

American Annals of Education and Instruction, for June.

The American Quarterly Review, for June.

The Ladies' Book, for June.

Museum of Foreign Literature, Science, and Arts, for June.

The committee on Inventions presented their reports on the following subjects, viz;

On Mr. Thomas Earle's improved Steam Boiler.

On Mr. Charles Thompson's machine for making Window sashes.

On Mr. Ebenezer Whiting's machine for cutting Bungs for Casks.

Which were read, and on motion referred to the committee on publications, with power to publish.

George W. Smith, Esq. to whom was referred the question—

What is the best unguent, and the most economical mode of its application, to diminish the friction of rail-way cars, locomotive engines, and other machinery of similar construction; stated, that the results of several experiments which have recently been made, have led to the conclusion, that the finest quality of sperm oil most effectually relieves machinery from the effects of friction. As the experiments, above alluded to, were still under consideration, and others about to be tried, to test the correctness of the conclusions already drawn, he requested that the consideration of the question should be named for discussion at a future meeting; and assured the meeting, that as soon as the decision of the final experiments should be known, he would lay the results before the Institute.

Professor A. D. Bache remarked, that Mr. Wood's experiments on the friction in rail-way carriages, had shown the fact to be in that case, as stated by Mr. Smith, and that those of Rennie led to the conclusion, that the nature of the unguent should bear some relation to the weights to be supported, or resistances to be overcome, the more fluid unguents applying best to light loads.

After which Mr. J. M'Ilvaine stated, that in using the various kinds of unguents on his machinery, he had come to the same conclusion as that stated by Mr. S. that the best quality of sperm oil was the most beneficial; having considered it as a question of much importance, he had devoted a considerable time to the subject, and was very particular in making his observations. He further

remarked, that the oil should be carefully cleansed, and deprived of those parts which water could remove.

SAMUEL V. MERRICK, *Chairman.*
FREDERICK FRALY, *Recording Secretary, P. T.*

REPORTS

Of the Standing Committee, appointed by the Franklin Institute, to examine the merits of such inventions or improvements as may be submitted to their consideration.

On a Machine for Cutting Bungs for Casks, &c. by Mr. EBENEZER WHITING.

THE committee on inventions, to whom was referred the consideration of Mr. Whiting's bung cutter,

Report, That in the opinion of the committee, the very compact and simple machine of Mr. Whiting is eminently calculated to answer the purpose of its invention. They find that it consists of a shaft six or eight inches long, to be fixed in the mandrel of a lathe. In the other end of the shaft is a pin capable of retreating against a spiral spring, within a cylindrical cavity at its axis. On this shaft, at convenient distances, are two transverse staples, in one of which is a joint of the cutting part of the tool, while the other (nearer the cutting end) serves as a guide to the cutter, in its movement about said joint. The cutting part is kept at a proper distance from the shaft by a spring between the two, admitting, however, sufficient motion to give the conical form to the bung.

From the specimens of its work which accompanies the description, there exists no doubt in the minds of the committee, of the entire adaptation of this machine to its intended purpose, and they feel entire confidence, that brewers, distillers, and others having occasion for a large number of cask bungs, will find their interests promoted by using Mr. Whiting's machine.

On a machine for making Window Sashes, by Mr. CHAS. THOMPSON, *Poughkeepsie, New York.*

THE Committee on inventions to whom was referred the consideration of Mr. Charles Thompson's "Machine for making Window Sashes,"

Report, that the committee have examined with care the models accompanying the specification of this machine, and that they have seen specimens of window sashes stated to have been made by the machine as now in operation on a large scale.

The "machine for making window sashes," as seen in the models before the committee, is in fact a series of no less than eight independent machines, to each of which, motion is communicated by any

convenient mover, through bands and pulleys, and thence, when necessary, through cranks, tangent screws, and cog wheels. The operations of sawing off, slitting, cutting tenons, making monions, and dovetails, are all performed by circular saws, furnished with suitable carriages and supports for the stuff on which these several operations are to be effected.

The cutting of grooves is performed by cutters revolving in the manner of circular saws.

The planing, ovoloing and rabbeting, are executed by suitable planes, moving with alternate motion in a convenient frame, in connexion with a fly wheel intended to produce regularity of action.

The mortising and coping are also performed by the alternate vertical motion of chisels, acting on the pieces placed upon supports, or carriages, beneath them.

The boring of holes for all the pins in the completed sash is effected simultaneously by a number of bits, moved by pulleys, connected by a common band, and placed in a frame which serves the additional purpose of pressing up, tightening, and giving the true rectangular figure to the sash.

The committee discover in the several machines an ingenious application of established principles and devices in mechanics, each apparently well suited to discharge the office which the inventor has assigned to it.

The very nature of the work to be performed implies the necessity of various and somewhat complicated machinery; but the committee do not find any part which, in the extensive operations of the machine, could be advantageously dispensed with.

The machine for cutting tenons is furnished with an apparatus for reversing the motion of the endless chain which carries the piece to be cut, and also with an arrangement for varying the speed of said chain. These parts, though not constantly employed, may probably be found useful, the former, to facilitate the removal of a piece whenever, by accident, the saws become clogged, and the latter to accommodate the amount of work to be done in a given time to the state of the saw teeth, and to the thickness and condition of the timber.

The committee feel assured that the machines now exhibited in model, may be found capable, if well constructed in working size, and adequately superintended, of executing a large amount of sashes in a day, and of diminishing the expenses of building, which, in rapidly growing towns and cities, and in newly settled districts of our country, is frequently no inconsiderable obstacle to the progress of improvement.

The work presented from the manufactory at Poughkeepsie was free from blemishes, and highly satisfactory in point of stability.

The committee can cheerfully recommend this machine to the attention of builders.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *washing Gold Ore*, and alluvial auriferous earth; John Powell, Salisbury, Rowan county, North Carolina, April 1. Granted in pursuance of a special act of Congress, passed February 12th, 1831; the applicant not having resided two years in the United States.

The washing in this machine is to be performed in a large shallow bowl, which is best formed of cast iron. For ordinary machines this bowl may be three feet in diameter, and one foot in depth. The inside is to be turned perfectly smooth, and at the bottom of it a cup-like cavity is to be turned, which may be three inches in diameter, and half an inch in depth. This bowl is to be placed on a vertical shaft, and is to receive a rotary motion, by means of a crank, and bevel gears. The ore, or earth, to be washed, is placed in the bowl, to which water is supplied in any convenient manner. When caused to rotate, the centrifugal force will throw the water, with the stones and light earthy matter, over the edge of the bowl, whence they fall upon an inclined plane, and are conducted off. The gold, with the heavier species of sand, and particles of plumbago, collect, from their superior specific gravity, in, or near, the cup at the bottom of the bowl. Mercury is sometimes to be used for the purpose of amalgamating the finer particles.

Some rakes and scoops are described, which are necessary auxiliaries in the process of washing.

The whole machine is considered as new, no claim being made to any of its particular parts, or to their arrangement.

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2. For an improvement in the *Thrashing Machine;* Gideon Cande, and Joseph Tousey, Rochester, Monroe county, New York, April 1.

The beaters consist of iron bars let into grooves, or spaces in a cylinder, and extending from end to end. The hollow segment consists of bars each fixed in separate slots in end pieces, and borne up to their places by means of spiral springs.

The claims are to "the manner in which the iron bars, or beaters, are constructed and attached to the convex cylinder; and the manner in which the ends of the bars in the concave cylinders are fixed, so that each iron bar may recede, as grain or other objects which enter the machine make it necessary.

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3. For a machine for *making Wood Screws;* Hazard Knowles, Colchester, New London county, Connecticut, April 1.

A machine to manufacture wood screws, is, of necessity, one of considerable complexity, as is evinced by all the machines for this

purpose which have been patented both here and in England. In the present instance the specification and references to the drawings occupy nearly thirty pages of foolscap paper; the description has evidently been given with great care. There is no claim made, which is to be regretted, as there must necessarily be some parts common to this and other machines for the same purpose. We do not think it necessary to attempt an explanation of the structure of that now patented.

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4. For *applying the Circular Saw to the cutting of Laths;* Chaning Madison, Miamiesburg, Montgomery county, Ohio, April 4.

The patentee says, "My claim to the invention of this lath machine, consists in the application of the circular saw to the cutting of lath off slabs at saw mills, as before mentioned."

We are very apprehensive that a claim to the application of the circular saw to the cutting of laths, would not be tenable, even if the thing had never been done, as the saw has been long in use for sawing strips in general; but its particular application to the sawing of laths has been before patented. There must, therefore, be some novelty in the construction of the machine upon which to found a valid claim.

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5. For *improvements in Metallurgical operations* for accelerating and improving the manipulations in general, with the use of anthracite coal in particular; Richard Wilcox, Patterson, Essex county, New Jersey, April 6.

This is the first of a series of three patents, all tending to the same end, as being parts of a general system for the reduction of metallic ores, and particularly that of iron.

The second patent has the following title.

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6. For *improvements in Metallurgical operations,* by the introduction and adoption of chemical agents which prevent the ores from oxidating, or volatilizing, either from a redundancy of caloric evolved during the fluxing of the ores, or the deleterious action of the gases, either in blast, reverberatory, or cupola furnaces or forges, &c. Together with further improvements in divers sorts of furnaces, cupolas, &c., April 5.

The third patent is—

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7. For *improvements in Metallurgical operations,* in the manipulation of metals in general, with bituminous coal, charcoal, coke, wood, peat, &c. April 5.

The series occupy forty well filled pages, and furnish an essay on metallurgical operations, rather than a mere detail of the improvements claimed, and such other matter as might be necessary to ren-

der the nature of these improvements clear and intelligible. The drawings contain 21 separate representations of furnaces in section. To give an analysis of these patents would demand more time and space than we can afford. In the first there are six leading improvements claimed. *First.* The concentration of heat, by the construction of the furnaces, as exemplified in the drawings. *Second.* Separating the ore from the coal, or any other combustible matter, and preserving them separate from each other during the manipulations. *Third.* Separating the metals in a lower or secondary reverberatory furnace, or furnaces, sometimes preserved at a regular and uniform temperature by additional fires. *Fourth.* Employing in this system not merely anthracite, but other kinds of fuel, and using not reverberatory only, but other kinds of furnaces. *Fifth.* Dispensing with the large quantity of oxygen gas which is usually forced into furnaces when the ore is in fusion. *Sixth.* The reducing the iron to a malleable state at one operation without exposing the cast iron to the injurious effects of the oxygen contained in the atmosphere.

The second specification describes the modes in which a combination of sand and clay is to be used in the furnaces, which mixture is to form a covering, or flux, to protect the ore and the fused metal from oxidation, volatilization, &c. and likewise the structure of the furnaces used by the patentee; the principle upon which these are constructed, it is stated, may admit of numerous modifications: the general principles, or modes of operation, however they may be modified, are claimed as the objects of the patent.

The third specification principally points out modifications in the manipulations, and furnaces, adapting them to the use of fuel other than anthracite.

The intelligence displayed in the general contents of these specifications inspires a belief in the value of the system adopted. This is no place for a critique upon the theoretical parts of the instruments before us, many of which, although they evince some acquaintance with chemistry, are very far from being invulnerable. If the processes are good, these mistakes are of little practical importance, and we name them principally for the purpose of stating that a specification of an invention, or discovery, is not an instrument of reasoning, but of description merely; that its object is to inform us how, rather than why, a particular thing is done. There are but few of those specifications which extend to twenty or thirty pages, as many do, which might not present every thing that is new, and requisite, in less than one-fourth of the space, and with more advantage to the public. We are fully aware that the aim of those who draw them up at such length, is to give in full detail every thing which appears to them to bear upon the subject, and that although unnecessarily long, the motive for making them so is praiseworthy.

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8. For a *Washing Machine;* Miller D. Mulford, Bloomfield, Ontario county, New York, April 5.

This is a box, or trough, hung upon gudgeons, and which is to be

rocked by hand. Notwithstanding the magnificence of this invention, there is no claim made to any part of it.

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9. For a *machine for Thrashing and Cleaning Wheat* and other grain; Samuel Lane, Hallowell Kennebeck county, Maine, April 6.

(See specification at p. 270. vol. vii.)

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10. For an improvement in *Fuel for manufacturing Malleable Cast Iron;* Seth Boyden, Newark, Essex county, New Jersey, April 6.

"The improvement consists in applying peat, or turf, as a substitute for bituminous coal, in manufacturing malleable cast iron, as described in a patent granted to me the 9th day of March, 1831. The improved fuel, or composition of peat and rosin, pitch, or tar, is free from the injurious effect of the sulphur contained in the bituminous coal. SETH BOYDEN."

We have, as in the specification referred to, given the whole of the matter contained in the description of the patentee.

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11. For *Glass Frames for Pictures, Looking Glasses, &c.;* John Scott, Philadelphia, Pennsylvania, April 6.

This patent is taken for a frame made of glass, whatever its form may be, and whether made in one or more pieces. Some century since, it was the common fashion to make looking glass frames out of glass variously cut, and ornamented. We are compelled, therefore, to place this patent among the *modern antiques*, where it will find many companions.

We have no doubt that the patentee prepares his frames in better taste than those made by our great grandfathers, and had his claim been confined to any new and improved method of construction, it might have been good; at present it is certainly too broad.

The drawing is without written references.

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12. For an improvement in the *method of Washing Rags in the manufacture of Paper;* John Ames, Springfield, Hampden county, Massachusetts, April 6.

(See specification.)

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13. For an improvement in the *Scoop Shovel;* Elisha Mudge and Rufus Tenny, Alexander, Genessee county, New York, April 6.

A piece of plank is taken which forms the back end of the scoop; a piece of sheet iron forms the bottom and sides of the shovel, and is to be nailed on to the edges of the plank. A handle, 2 feet 3 inches long, is to be attached to the plank, and properly secured and

braced. This constitutes the whole of the *conjoint invention* of the patentees. There is no claim, and no references to the drawing.

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14. For an *apparatus for preventing the Bursting, Collapsing, or Burning of Steam Boilers;* William A. Turner, Washington county, North Carolina, April 6.

This specification describes modes of operation analogous to those contained in the patent obtained on the 15th of last month, by the same gentleman. There is to be a door or shutter, which may be placed in the top of the boiler, which is to open upon hinges, instead of working in slides. By the intervention of several levers, this door is connected with the safety valve, and when the valve rises, this door, or shutter, is liberated, and is to open and allow the steam to discharge readily. A damper is at the same time to close the draft of the furnace, and streams of water are to pour upon the fire. Besides this, there is to be a fusible metal piece attached to the lower side of the boiler, and when this melts, a weight causes a rod to ascend, which passes through a stuffing box in the top of the boiler, when effects are to ensue similar to those produced by the rising of the safety valve. The array of catches, levers, and other appendages is equal, if not superior, to that of the former patent. If the safety of boilers cannot be established without the addition of numerous parts, every one of which is liable to derangement, we must make up our minds to run the risk of explosions. The effects of temerity, ignorance, and avarice, will not be prevented by such means. The present patentee has evidently been at much pains to attain the end desired, but we are convinced that his plans, if essayed, would prove to be entire failures.

There are no claims made in either of his patents.

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15. For *Making Coke from Anthracite Coal,* for smelting ores, and for the preparation of steel; Moses Isaacs, Philadelphia, Pennsylvania, April 7.

The patentee informs us, that to convert anthracite into coke, he piles it up in the form of an arch, or cone, leaving space for the combustibles, and to heat it sufficiently; for this he uses wood, rosin, pitch, tar, or any similar substance; he places one or other of these under the anthracite, and kindles it, "to expel the vapour, foul air, dampness, &c. it renders porous, I throw on a quantity of water and flour, or water and lime mixed, or a quantity of glue, clay, or any other earthy or other substance which will dissolve in water, and stiffen or harden by being exposed to heat or air, for the purpose of cementing it together, which cools, and leaves it united, or coked, free from receiving foul air, dampness," &c.

We know something about anthracite, coke, and other kinds of fuel, but not enough to appreciate the value of the present discovery; to those whose understandings are less obtruse, we therefore commit the investigation.

The patentee, it appears, is not a citizen. He has not, however, taken the oath which the patent law prescribes to aliens.

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16. For a *Metronome, called "The Accenting Metronome,"* to be used in teaching music; Uri Emmons, city of New York, April 7.

Those skilled in music, know that the ingenious Mr. Maelzel invented an instrument for beating time in music, which he called a *Metronome.* The beats were made by a pendulum, and the time changed by moving a sliding weight upon its rod. Mr. Emmons, instead of a pendulum, uses a fly, the wings of which are adjustable, as they can be made to approach to, or recede from each other, and thus alter the time of their gyration.

The instrument is to be wound up like a time piece, it having a barrel, and weight, connected with the movement necessary to act upon the fly. The time is counted by hammers striking upon a bell, which bell may be muffled by a piece of leather interposed between it and the hammers.

The claims are to "the simple form and construction of the above described machinery; especially that of dividing the time on the degrees of the wheel, and of arranging and lifting so as to produce the changes, and both common and treble time, with all the accents according to the different moods, together with the construction and application of the fly and index, by which the different motions are marked and regulated."

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17. For a *Vessel for boiling Liquids of all kinds;* Richard M. Beach, Franklin, Delaware county, New York, April 7.

This vessel is a wooden trough with a bottom of sheet metal; it is to be set in brick work, so that the fire applied may come in contact with the bottom only.

Wooden boilers, with metal bottoms, have frequently been made, and are applied to various purposes.

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18. For *manufacturing Spades and Shovels* by means of machinery; Charles Richmond and Samuel Caswell, Jr., Taunton, Bristol county, Massachusetts, April 7.

(See specification.)

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19. For an "*Inclined Plane Friction Roller Press;*" Luther Carman, Oxford, Oxford county, Maine, April 7.

(See specification.)

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20. For an improvement in the *art of Churning;* Elias V. Coe, Warwick, Orange county, New York, April 7.

"The following is a full and exact description of the art or manner of churning as invented or applied by me; which consists in the

application or forcing air into milk or cream, by means of an air or forcing pump, bellows, or other like machinery or instruments, propelled by hand, water, weight, steam, wind, animal, or any other power. ELIAS V. COE."

The foregoing brief, but emphatic, lines, constitute the whole of the specification. There, however, is a drawing accompanying it, with copious references, in which a jack is represented, which is to be driven by a weight of 300 pounds; this weight, through the intervention of the requisite wheel work, a part of which is "a wheel of three feet diameter, with 120 teeth," works two pair of small bellows which blow their wind through a leather tube into the barrel of cream. The whole appears to us rather airy, notwithstanding the great weight employed.

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21. For a *Mould for making Scythe Sneaths;* John Knight, Woodbury, Gloucester county, New Jersey, April 8.

A mould is to be made for the purpose of bending the timber into the desired curvature, and as the sneath is usually bent in two ways, the mould must be formed accordingly. This is to be effected by marking the intended curvature in one direction upon a piece of timber of sufficient thickness, which may then be sawed through in the line of the curve. Upon the edge of one of these pieces a furrow, or groove, is to be made, having the curvature in the other direction; the furrow must be of such size as to allow the sneath to pass into it. When these two pieces are put together, they form the mould. The timber worked straight, and to the proper size, is to be softened by steam, driven endwise into this mould, and allowed to remain until it has obtained its proper set.

There is no claim made, but as the bending by steam is a common process, and not, therefore, the subject for a patent, the particular manner of making the moulds must be the thing intended to be patented; this we believe to be new, and it may consequently be legitimately claimed.

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22. For a *Machine for making Horse Shoes;* David Anthony, Jr., Adams, Berkshire county, Massachusetts, April 8.

The horse shoe is to be formed by means of wheels, or rollers, of which there are to be four; they are to be made narrow upon their faces. These rollers have axes, the gudgeons of which run in a strong iron frame, in the centre of which their faces meet; they stand opposite to each other, in pairs, so that a section through their axes would form a +. They are geared together by bevel wheels, and all turn simultaneously. Their edges are bevelled, to bring them in contact, and their faces are so formed that a bar of iron passed between them will assume the shape required, and be countersunk, so that when bent round, the horse shoe will be in a nearly finished state. The wheels may be of such circumference as to form three shoes at one revolution. From these rollers the iron passes on to an apparatus

for bending it round in the required curve. The claim is to "the machine for making horse shoes as above described."

We have no doubt that a machine of the foregoing kind, if made with great precision, will give to the iron the shape desired, but as regards the validity of the claim, the same circumstance which interferes with many *new inventions*, stands in the way of this; it unfortunately is old. A machine of this description was first brought into use in England, and was eventually imported into France. Of the period of its invention we are not informed, but in the *Recueil Industriel*, for December, 1828, published in Paris, a description and plate of this instrument may be found. It is there denominated "a machine which is to give to iron all the different forms required in the arts, by means of a continuous rotary motion." The French account remarks that by an engine of eight horse power, operating upon a machine of the size designated, 3,000 nails of an inch in length, might be manufactured in a minute; and that by its aid iron may be converted into any desired form in a very rapid and exact manner.

A comparison of the patent before us, and of the accompanying drawing, with the description and engraving in the above journal, will remove all doubt with regard to the perfect identity of the two machines.

The opposite sketch will afford some idea of the manner in which the wheels, or rollers, run together. Were their angular points taken off, a square bar might be formed by passing the metal between them; and other desired shapes, it is evident, might be produced, by indentations of the proper form.

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23. For *applying steam for blowing Fire;* Joel Eastman, Bath, Grafton county, Maine, April 8.

This patent is for applying an aelopile to the blowing of a forge fire. A strong cylindrical boiler is to be made, capable of containing two quarts of water. This is placed so that it may receive the heat of the fire, and, when necessary, some ignited coals are to be put under it; from the top of this boiler, a tube descends and terminates in the mouth of another tube which forms the tuyere. The opening in the steam tube is to be from one thirteenth to one sixteenth of an inch in diameter, whilst the tuyere tube is to be two inches in diameter at the outer end, and about one where it enters the fire. The claim is to "the application of steam to the blowing of fire as above described."

There is nothing new in the principle employed, or in its application. In the older, as well as the more modern books of philosophy, the principle is explained, and its application shown. It is not, in fact, the steam which feeds the fire, but, as this rushes forward it carries with it a considerable volume of atmospheric air, which produces the combustion. If an ignited coal be placed close to the steam tube, it will be extinguished; if at a distance, its combustion will be promoted.

In practice the plan will not be found to answer any good purpose, as the blast cannot be sustained and regulated, as with the common bellows. The contrivance is to be considered as a philosophical toy, rather than a thing of practical utility.

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24. For a *Thrashing Machine;* Wm. B. Marks, Petersburg, Dinwiddie county, Virginia, April 8.

"What I claim as my invention is the reversed twisted bars on the cylinder, and concave bed, and their position as described in each, and also the twisted rods, or bars, and their oblique position as placed and described on the under feeding roller." So ends the specification.

If we could find any novelty in this arrangement, it would be some relief to point it out, as we are really tired with the almost perpetual repetition of the same opinion, that "there is nothing new." It might save trouble to our printer were he to get these words stereotyped.

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25. For an improvement in *Mills;* being a mode of using the tread wheel, by combining its power with that of the tub wheel; Elias Davis, Bangor, Penobscot county, Maine, April 9.

The patentee claims as his invention or discovery, the *new principle* contained in his description of his mill. This new principle is to enable "a given power, (horse power,) applied to the tread wheel, to produce double the momentum that it has ever before been found capable of producing."

What the new principle is we have not been able to discover, as we see nothing more than a tub wheel on a vertical shaft, which is to aid and be aided by a horse wheel, the power of the two being conveyed to mill stones through the intermedium of a number of cog wheels, regulated by the momentum of fly wheels. There are altogether 9 or 10 wheels, which, we suppose, are, by their mode of combination, to produce the double effect claimed.

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26. For a *Cylinder Corn Shelling Machine;* Jabez Parker and Hiram M. Smith, Richmond, Virginia, April 9.

This shelling machine has a cylinder with ribs of iron set spirally operating round it, like the teeth in the original corn sheller. The alterations, or improvements, upon which the patentees rely, is the increasing the velocity of the cylinder three fold, by gearing, which, whilst it reverses the motion of the cylinder, enables the operator to turn the crank with his right hand, and feed the hopper with his left. The manner of fixing the springs to adapt it to ears of different sizes. The bending of the iron ribs in such a way as to throw the cobs from the machine, and the "making the frame in an easy, simple, triangular form, thereby making it a firm, substantial brace to itself." We are assured that "by those improvements the machine is made for about the same expense as the former kind; is more

substantial and durable, and less liable to get out of order, is easier managed, will do the work better, and about three times as fast, with only half the labour." A gain of sixfold is a great gain, but notwithstanding this assurance we apprehend that it will be hard work even to feed with three times the ordinary speed.

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27. For *Propelling Boats, Mills, Cars on Rail-roads, &c.*, by the means of a lever purchase, operated upon by cranks; Aaron Parkhurst and Silas Bacon, Scriba, Oswego county, New York, April 11.

We have here a train of wheels, cranks, levers, ropes, and pitmen; to be set in motion by the power of two men by the means of handles or levers, which are fastened to the wheels, one to each. Or there may be steam applied to a third wheel, by adding two cranks, &c. "or with water power on a wheel with the cranks." To this apparatus, which is at war with the horn book of mechanics, there is no claim; we do not apprehend, however, that the omission will be productive of any inconvenience to the patentees.

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28. For a new and useful *mode of rendering a variety of articles water proof*, by means of fluid caoutchouc; George H. Richards, city of Washington, D. C., April 11.

(See specification.)

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29. For a *Machine for mixing Clay or Mortar;* Aaron Parkhurst, Scriba, Oswego county, New York, April 11.

A circular trough, of the kind frequently used for mixing clay, is to stand upon a platform elevated for the purpose. Horses walking upon this platform turn a horizontal shaft, which carries a *mixing wheel.* The mixing wheel stands immediately above the circular trough, and from the lower side of its spokes iron spikes project downwards into the trough, these are to work the clay, or mortar. When mixed, a slide is removed, which allows the material to fall through into a receiver below the platform.

The part claimed is not designated.

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30. For a *Machine for Washing and Churning;* John White, South Union, Logan county, Kentucky, April 12.

The body of this machine is a tub in the form of a common pickling tub; that is made larger at one end than at the other; slats of wood run from end to end on the inside, and the tub has gudgeons on the centre of each head by which it may be hung horizontally. There is a door for the admission of the articles to be operated upon.

When clothes are to be washed, the machine is to receive 20 or 30 turns in one direction, and then an equal number in the other, and so on alternately. In consequence of the conical form of the tub, the revolution of the barrel, causes the clothes to twist up; the

reversed motion twists them in the contrary direction, and this alternate twisting is said to clean them thoroughly without injury. Its operation as a churn needs no explanation.

The claim is to "the so forming the tub, that in washing, the clothes shall be alternately twisted and untwisted, in the manner above described, with the slats contained therein; and also the application of a similar tub to the purpose of churning."

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31. For a *Smut Machine*, for cleaning grain; Levi Hayward, Phelps, Ontario county, New York, April 12.

The grain to be cleaned is dropped from a hopper into a hollow cylinder of sheet iron, standing horizontally, a large portion of the inside of this cylinder is set with spikes. A fan, with four wings, is made to revolve in this cylinder with a speed of seven hundred times in a minute; this is to throw the grain and smut against the spikes, which operation cleans the grain, and pulverizes the smut. From the cylinder the grain passes off into the eye of the stone, and in its passage the smut is blown from it by means of a fan wheel.

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32. For an improvement in the *Water Wheel;* Martin Coney, Portland, Chataqua county, New York, April 12.

This is the often proposed plan of a strap, or endless chain, passing round drums, with buckets attached, to be operated upon by the water; there are no details setting forth any improvements, the whole description being general and imperfect.

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33. For a *Machine for Breaking Stone* for turnpiking and other purposes; Benjamin F. Lodge and Ezekiel T. Cox, Zanesville, Muskingum county, Ohio, April 12.

A cast iron bed piece is to be provided, upon which the stone to be broken is placed. This bed piece may be about a foot in diameter, is to be concave on its upper surface, and perforated with holes for the broken stone to pass through. A ram or hammer is to slide between cheeks, or to be hung like a tilt hammer, for the purpose of breaking. The face of this hammer is to be furnished with projecting pieces, adapted to the holes, and suited to the concavity of the bed. Any of the known motive powers may be used to work the hammer.

"What we claim principally as new and useful, is the form of the bed, or block, and hammer; that is, the concavity of the one, and the convexity of the other; for we are aware that there has been an attempt made to introduce cast iron plates, or blocks, with holes for the purpose of breaking stone as above; but having a level surface, and being worked by a common sledge, or hand hammer, they have been abandoned as useless. The stone having a bearing upon the plate or block, directly under where the blow was applied, it resisted the force of the blow, and the blow produced little or no effect, and the pieces of stone broken off were liable to fly in any direction;

whereas our machine, having a concavity in the block, or bed, the stone has no bearing in the centre; and the hammer, of corresponding convexity, strikes first in the centre; the consequence is, that the stone is broken into a number of pieces the first blow, and the hammer being as wide as the bed, or block, prevents the stone from flying."

A machine for breaking stone, patented by Messrs. Bell and Andrews, is noticed at page 294 of vol. 6. In that, hammers, hung like trip hammers, are to be used, and the stone broken by them upon iron bars.

Machines for breaking stone are used in England, and are in some cases operated upon by steam; we have not met with any description of their precise construction. We could urge several objections to each of the machines patented here, and believe that the patenting them has not resulted from an experience of their practical utility; perhaps, however, when put into operation, they may serve as the foundation of good instruments. It is not to be expected that any machine, excepting it be one of the most simple kind, will fulfil the anticipations of its projector, without undergoing various modifications suggested by actual trial.

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34. For a *process by which the Mineral Water of Congress Spring, at Saratoga, may be imitated;* William Meade, M. D. Newburg, Orange county, New York, April 12.

The receipt given is as follows—

1st. Take of tartaric acid, perfectly free from sulphuric acid; dry it in a very moderate heat, and then grind one ounce of it into a fine powder.

2nd. Take super carbonate of soda one ounce and a half, after it has been dried sufficiently to deprive it of its water of crystallization, and pulverize it.

3d. Take muriate of soda half an ounce, after it has been dried in a moderate heat, to deprive it of the whole of its water of crystallization, without decomposing it, and as much depends on the purity of this salt, it will be necessary to attend to the following particulars; it must be entirely deprived of muriate of lime and magnesia, which are generally combined with all species of common salt. They should be got rid of by pouring on the salt a sufficient quantity of alcohol of as high specific gravity as 826; this will take up the deliquescent salts, and leave the muriate of soda untouched; it must then be passed through a filter, and the muriate of soda made perfectly dry, after which it should be finely powdered, and one-half ounce of it carefully weighed.

4th. Take a small quantity of crystallized green vitriol, or sulphate of iron, expose it until it has fallen into a dry white powder. This must be added to the above powders in the following manner.

To one ounce and a half of the carbonate of soda, add two grains of the sulphate of iron, triturate them together; then add by degrees

half an ounce of the prepared muriate of soda, then one ounce of the tartaric acid, and triturate the whole until they are intimately mixed.

This powder is to be put into a perfectly dry bottle, to be kept closely corked, and when wanted for use, a small teaspoonful of it put into a tumbler, which is to be immediately filled with cold water, stirred, and drank, whilst in a state of effervescence.

We presume that Dr. Meade may sustain his claim to the precise mode of imitating the Congress Spring water, described by him; but certainly he cannot prevent any other person from combining together the ingredients which have been detected in it by analysis. That skilful chemist, Mr. G. W. Carpenter, of Philadelphia, has, for two or three years past, supplied the public with *Saratoga Powders for making Congress Spring Water.* These powders are noticed in the 16th volume of Silliman's Journal, p. 396. We are not informed of Mr. Carpenter's mode of preparing them, but he has made analysis his guide, and it is averred that they contain "all the essential substances with which these celebrated springs are impregnated, and from which the waters of the Congress Spring at Saratoga are precisely and effectually imitated."

A more simple process than the use of alcohol, will remove the muriates of lime and magnesia from common salt. All that is necessary is to pass through it a heated solution of itself in water; the water will dissolve the deliquescent salts, and deposite its own muriate of soda.

There is no *water of crystallization* in muriate of soda, although a minute portion is entangled among its crystals. There is no danger of *decomposing it*, in the drying, as heat alone will not produce this effect. The precaution given is therefore unnecessary.

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35. For a *Machine for Shelling Corn;* Joel Barnes and Nelson T. Loomis, Cornwall, Litchfield county, Connecticut, April 13.

A solid cylinder of wood is to have iron teeth driven into it, as in the original shelling machine. A hollow curve is to be adapted to this cylinder, between which two parts the corn is to be shelled. Particular directions are given respecting the manner of forming this curve, which particular mode, or modes, constitute the essence of this invention, the claim being to "the construction and operation of the curves."

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36. For a *Thrashing Machine;* Newton C. Munroe, Windham, Green county, New York, April 14.

We are told that the improvements in the thrashing machine here patented, "consist in the arrangement and form of the teeth in the cylinder and concave; the method of making and regulating the concave to adapt the machine to thrashing different kinds of grain, and in the mode of gearing, and applying power to drive the machine."

The teeth of the cylinder are to be made of No. 2 wire, and to extend out one and an eighth inch. The teeth are to be in rows, the tooth of one row standing opposite to the space in the next row. One-

half the rows of teeth stand straight out, forming radii from the centre, the other half are to be curved forward. The teeth of the hollow segment are of the same kind with those of the cylinder, but are all to curve forward, towards the point at which the grain is delivered.

The machine is to be driven by a horse, attached to a sweep turning a vertical shaft, with the gearing necessary to give the cylinder the proper velocity.

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37. For a *Wheel for Propelling Boats*, being an improvement upon Antrim and Bolton's water wheel; Phineas Palmiter, Jr., Jamestown, Chataque county, New York, April 14.

A general description is first given of Antrim and Bolton's wheel, which description will answer very well for several different propelling wheels that have been patented, and which are intended to have their buckets kept in a vertical position. Those familiar with the subject are aware that this is in general effected by two wheels running eccentrically, and so connected as to produce the intended effect. We have not sought out the date of Antrim and Bolton's patent, not deeming this a point of any importance. We have noticed numerous wheels having the same object in view, but have never expressed an opinion favourable to any one of them, although we have several times been called to admire the ingenuity displayed in their construction. The present patent is taken for a new modification of the same principle; it has the merit of greater simplicity than most of those which have preceded it, but still we think that it will not be found equal to the simple wheel commonly used. This opinion is justified by the trials that have been made with similar wheels, which, upon fair and long continued experiments, have not been found to give an increased velocity. They must, however, excel greatly in this particular, or they will never be brought into use, as they are much more costly and liable to derangement than the old paddle wheels.

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38. For a *method of Generating Gas, and of supplying and continuing Gas Light* out of oil or other suitable substance, by means of the gas light itself, in lamps, or machines, either fixed or moveable; Solomon Andrews, M. D., Perth Amboy, Middlesex county, New Jersey, April 15.

(A description of this, and of an auxiliary patent since obtained by Dr. Andrews, will be given in the next number.)

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39. For a *Machine for Jointing Staves for Barrels;* George Eby, Clarence, Erie county, New York, April 15.

There are two jointers, each furnished with two plane irons, fixed by wedges in the ordinary way, but standing in opposite directions, so that they may joint a stave passing either backward or forward. These jointers are connected together by straps of iron united by pins, which pass through holes at a distance from the jointing part of

the planes, equal to that of the semi-diameter of the barrel to be formed; the faces of the planes standing in the direction of radii from these pins as centres. By means of a treadle, the faces of the jointers are made to approach each other, and joint the two sides of a stave at the same time; giving the correct bevel to the edge, whatever may be the width of the stave.

The stave is attached by suitable fixtures to a jointing bar, which is made to pass backward and forward, carrying the stave between the jointers, and tilting it so as to bring it alternately in contact with the irons at each end, in order to give it the required taper.

The claim is to the manner of fixing and working the jointers; the jointing bar; working and tilting as described; and the general arrangement of the machinery for producing the intended effect.

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40. For an improvement in the manner of *constructing Ships and vessels of every description*, either for the purposes of war or commerce; R. Deming, city of New York, April 15.

(See specification.)

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41. For manufacturing *Wooden Ware without Staves;* John Patridge, Zanesville, Muskingum county, Ohio, April 16.

Tubs and buckets of various kinds have long since been made by turning the rims out of a block of wood, and afterwards fixing the bottoms in them. On examining the specification of the present patent we are not aware that it presents any important improvement; the patentee lays claim, however, to "the manner of fixing the block in the lathe; the application of a gauge gouge and croes at each end of the rim; the saving operation of labour, and saving of timber; the gauge gouge and croes, [tools for cutting the groove,] to receive the bottom."

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42. For *Apparatus for communicating Power to Machinery;* Samuel Kilburn, Sterling, Worcester county, Massachusetts, April 16.

The power with which this machine is to operate is derived from the weight of an iron ball, or other heavy body, attached to a shaft by a swiveling joint. By means of a crank the shaft to which the ball is attached is made to revolve; the ball, in revolving, acts upon two treadles, depressing them alternately. The power which is thus to be *generated*, is to be communicated to machinery by cranks and shackle bars, or other connecting parts.

The claim is to the making of the ball, or other heavy body, operate upon treadles as above described, so as by its gravity to concur with them in their descent.

Some ingenuity is manifested in the arrangement of the parts, although it is unfortunately expended in the construction of a machine to *absorb* and *extinguish* power.

43. For an improvement in the *art of Teaching Arithmetic;* Oliver A. Shaw, city of Richmond, Henrico county, Virginia, April 16.

It is proposed to make blocks of wood, or other material of different sizes, in regular progression, or bearing a certain ratio to each other, and by the arrangement, or alternation of place in these, to give sensible solutions not only of the cardinal rules, but also in decimal and vulgar fractions. The claim is to "the mode of teaching arithmetic as above described."

We have not only prepared blocks of wood upon the principles described, but have divided them into squares upon their surfaces, in order to illustrate both their relative proportions, and also the involution and evolution of numbers; but when we did this, we had not the most remote idea that we were establishing any claim to invention, or discovery, and have no doubt that at the period to which we allude, some thirty years since, the plan was then older than "auld lang syne."

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44. For an improvement in the *Marine Railway*, called by the patentees "an improvement in the art of moving vessels or other heavy bodies on rollers;" Richard P. Joralmon, and Isaac Lockman, Northfield, Richmond county, New York, April 16.

The improvement here claimed consists in the use of rollers of a certain description, to serve as guides, as well as to diminish the friction in raising vessels up an inclined plane. The following extracts from the specification will afford a good idea of the plan.

"There are two streaks of timber, commonly called ground ways, about one hundred and fifty feet long, ten feet apart, lying parallel with each other, extending from the shore into the water, on an inclined plane, firmly fastened down, which have a surface of thirteen inches wide, on which are fastened two streaks of bar iron, running the whole length of the ways; these bars are placed four inches apart; there are rollers of cast iron, thirteen inches long, four inches in diameter, with a gudgeon on each end of two inches diameter; the rollers in the middle, for three and a half inches in length, are five inches in diameter, forming nearly a square shoulder at each end of the thick part of the rollers. These rollers are put in frames made of plank two and a half inches thick and nine inches wide, the plank being fastened together with pieces of wood, and cross braced to prevent them from racking; the rollers are placed in these frames at the distance of three feet apart; the gudgeons being in boxes of cast iron which are let into the plank. The rollers thus arranged, are laid upon the ground ways, and the swell or shoulder of the thick, or middle, part of the rollers, playing between the bars of iron on the ground ways."

The claim is not confined to the materials or dimensions given, and it is observed that the plan is equally applicable to inclined planes for canals, and also to the removing of heavy bodies in other situations.

45. For a *Pump for Raising Water or Air;* Jedediah Beckwith, Saratoga, Saratoga county, New York, April 16.

"The machine is a flat, water or air tight, circular box of iron or other metal, or sufficient material, of any required dimension or capacity, made stationary, and a valved wheel of like metal or material, revolving within the box by any power applied to a shaft or axle running through the outside plates, and upon which the wheel is suspended, with two holes through the rim of the box, one to admit the water or air into the machine, and the other to discharge it."

The remainder of the description consists of references to the drawing, which represents a well known rotary pump, made like many of the rotary steam engines which have been devised. The inside cylinder carries four hinged valves, which fill the annulus in which the water, or air, is to be contained, and close as they pass a metallic projection between the receiving and the discharging pipes. He must be a very good workman who makes such a pump *air tight;* and after he has done so, although his pump will certainly be distinguished by the skill it displays, there will be no novelty in its construction.

There is no claim made.

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46. For a *Rotary Steam Engine;* Abel Greenleaf, Paris, Oneida county, New York, April 16.

The greater number of rotary steam engines which have been devised, differ from each other principally in the construction of, and in the manner of opening and closing the valves, and such is the case in the present instance. The description refers throughout to the drawing which accompanies it. The claim is in the following terms.

"What I claim as my invention, is the conical form given to that part of the shaft upon which the cylinder revolves, for the purpose of adjusting them to each other without packing; the attaching the piston to the arm, or lever, in such way as to give it play enough to adapt itself to the chamber of the cylinder. The manner of forming the piston in parts, so as to adjust it to the cylinder; and the particular manner in which the valves are made to slide through the head of the cylinder into the valve chambers."

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47. For *using Zinc or Spelter for making various articles of Hollow Ware;* Samuel Davis, city of New York, April 18.

The specification is as follows.

"Be it known that I, Samuel Davis, of the city of New York, have discovered that zinc or spelter is well adapted to making various kinds of hollow ware; such as pots, kettles, pans, basins, dishes, pitchers, dippers, ladles, mugs, boxes, mortars, churns, firkins, inkstands, urns, knobs, ornaments for cornices and for stoves, looking glass and picture frames, sad or flat iron stands, andirons, sea boards for vessels. SAMUEL DAVIS."

The specification of a patent obtained by the same gentleman, for *extracting cream from milk,* is inserted at page 368, vol. 6. In this

it will be found that vessels of zinc were proposed for containing milk or cream. The claim there made is in the following words: "What I claim is the manner of using the mineral called zinc, or spelter, in the reservoir, or vessels, containing the milk; and *preparing vessels or pans* from the zinc, or spelter." It will be seen, therefore, that the two patents are, in part, for precisely the same thing, and of this the law will not admit; otherwise, instead of having his patent for fourteen years, a man might contrive to render it perpetual.

It appears to us rather strange to say that it has been newly *discovered*, that a well known metal, which has been long since rendered malleable, which has been made into pipes, spouts, and other articles, which has been used for sheathing vessels, and covering houses, and has been cast into various forms, is "adapted to the making of various kinds of hollow ware," &c. If the inquiry be made why this has not been generally practised, we reply that it is entirely unfit for containing articles of food, as it is more readily attacked by acids than any other metal, and as its salts are more or less poisonous.

The total want of novelty in its application to culinary purposes might be easily shown; indeed it is sufficient for this purpose to turn to the article Zinc in Rees's Cyclopedia, where it is observed, that "it has been recommended instead of tin and lead for domestic purposes; but the ease with which it is oxydized, makes it very unfit for all kinds of culinary apparatus."

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48. For a *Life Escape, and Fire Ladder;* James Johnson, city of Baltimore, April 18.

A car is made to run upon wheels; this car has a considerable elevation, and is so constructed as to form two or more platforms, retiring like steps, one probably ten feet above the other. The ladder, in sections, is to reach from one angle of these platforms to the next above it, where it is to be secured. Firemen with hose may stand upon the platform, and play directly into a window.

The apparatus is very indifferently described, and, as presented, appears liable to many objections. A carriage of this description requires too much space to admit of many of them being kept in large cities. Its elevation is such as to render it very liable to be upset in the hurry of repairing to fires, and when placed against a building which is on fire at the lower part, the machine will be in contact with it, whilst a common ladder would stand clear. There have been many contrivances made for a similar purpose, but they have not proved to be practically useful, being liable to the objections stated, or to others equally formidable.

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49. For an improvement in *Couches, Sofas, Settees and Chairs*, called the "Windlass couch, sofa," &c.; Charles Adams, Boston, Suffolk county, Massachusetts, April 18.

The claim is to "applying the windlass principle in binding and

holding together the parts, and tightening the sacking or other material upon which the cushion lies."

The plan resembles that adopted in bedsteads, and for which a patent was obtained by the same gentleman. The rails are made round, and have round tenons, with a ratchet wheel and click at one or both ends of them. By means of these, sacking bottoms, cords, or similar appendages may be tightened.

The advantages stated to accrue, are the facility with which the before mentioned articles may be kept tight; the rendering the seats always firm and elastic, with less expense of material than when stuffed in the common way. The facility of taking apart and stowing for transportation; and greater economy in construction.

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50. For an improvement in *Door Locks;* Andrew Wolfe, Pittsburg, Allegheny county, Pennsylvania, April 18.

Spiral springs are substituted for the usual flat spring over the tumbler of a door lock.

"All that I claim as my invention, is substituting spiral springs for the common flat spring. Said springs resting perpendicularly on the tumbler, with the cylindrical piece of metal in the centre of each spring secured to the tumbler, and working loosely in the groove on the under side of the square mortise; thereby rendering the lock more easy in its movements and more durable; the springs not being liable to break or lose their elasticity so soon as the common flat springs."

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51. For a machine for *Cleaning Fur;* William Woodworth, city of New York, April 19.

(See specification.)

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52. For an improvement in the mode of *Casting Metallic Tubes,* or pipes, of lead, or other soft metals; Burroughs Titus, Ulyssus, Tompkins county, New York, April 19.

(See specification.)

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53. For an improvement in the *Navigation of Canals by Boats;* Samuel D. Ingham, New Hope, Bucks county, Pennsylvania, now residing in the city of Washington, April 19.

"This invention consists in the construction of a boat with a paddle wheel, or wheels located in its forward part, or bow, which wheels may be applied to any form of boats now in use, but most advantageously to that form usually denominated a twin boat."

It is proposed sometimes to put two wheels in the bow, in such positions as to propel the water along the interstice between the twin parts of the boats.

It is observed that these wheels may be propelled by steam or any other power; that when steam is used, one boiler and two engines,

one on each side of the boat, will be the most advantageous; the pistons being placed horizontally.

The object proposed to be attained, is to prevent the swell of water in front of the boat, and the depression of it in the rear, which occurs when boats are towed, or propelled by paddle wheels on the sides.

There is no claim made, but from the tenor of the instrument, it would appear that the placing of a wheel, or wheels, in the bow of the boat, is the point relied upon. This in itself is not new, and we do not therefore perceive any thing by which the patent is to be sustained.

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54. For a *Thrashing Machine;* William J. Wood, Gennessee county, New York, April 19.

Instead of a cylinder with teeth, there is to be a wheel like a wagon wheel, one side, or face, of which is to be covered with teeth, or beaters, to a considerable distance from its periphery, towards the centre. This wheel is to run against a corresponding piece furnished with teeth. The construction and arrangement are not clearly described, or distinctly represented in the drawing, nor is there any claim made.

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the method of Washing Rags for the manufacture of Paper. Granted to JOHN AMES, *Springfield, Hampden county, Massachusetts, April* 6, 1831.

THE improvement consists in dispensing with the washers, or screens now in use, and substituting in their stead a wire cloth cylinder, for carrying off the dirt and filth which may be beaten from the rags, or held in solution in the water, without the waste and delay of the old mode. The cylinder used by me is about twenty-two inches in length, and twenty-two inches in diameter, hollow, closed at one end, open at the other, surrounded by two coats, or coverings of wire cloth, and revolves upon an axis. I construct the cylinder as follows: the frame consists of metallic rods of suitable length, and sufficient in number to give strength and form to the cylinder, running parallel with the axis, and supported by arms of the same metal. Over these rods is first stretched a coarse wire cloth, and then over that is stretched another wire cloth of finer texture; any reticulated material, however, will do for the inner covering, as its principal object and use is to support the outer one without opposing any considerable obstacle to the free passage of the water into the cylinder. The cylinder is left open at one end, but is entirely closed by a metal disk at the other. Thus constructed, it is fixed in the washing vat, or engine, resting on arbours, with the open end adjusted to the side of the engine or vat, so closely as to prevent a waste of the

stock, and placed at a convenient height to allow a free passage of the rags around in the engine.

Within the circle described by the periphery of the open end of the cylinder upon the side of the engine, an orifice is made to let off the water which percolates into the cylinder. A band or gearing connected with other parts of the machinery communicates a rotary motion upon its axis to the cylinder, corresponding with the current, or roll of the stuff in the engine.

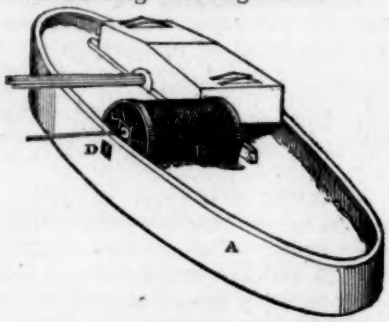
The benefit and utility of this improvement consist, 1st, in the saving of time in the preparing the rags for manufacture; 2nd, in dispensing with the washers now in use; 3d, in preventing a waste of stock, which in the ordinary mode of cleaning is very considerable. By my improved mode the dirty water is made to pass off more rapidly, and of course the clean water can be admitted more freely than when washers are used, through the apertures of which the pulp is driven by the force of the roll, or motion of the beaters, and so wasted, or clogs the washers by filling up the apertures, and prevents the passing off of the dirty water. By the rotary motion of the cylinder, by my mode, coinciding with the roll of the stuff, the water is freely received into the cylinder, and passes off.

The improvement which I claim especially as mine, is the process, or method, of washing, or cleaning, rags, by adapting the wire cloth cylinder to the common washing engine divested of its washers, to effect the objects before mentioned.

The wire cloth cylinder I do not claim as my invention for which I now seek a patent; it having been before patented by me.

JOHN AMES.

Ames' Rag Washing Machine.



A, the vat.

B, the wire gauze covering to the cylinder.

C, the open end of the cylinder running close to the vat.

D, the opening through which water escapes.

Specification of a patent for an improved mode of manufacturing Spades and Shovels, by means of Machinery.—Granted to CHARLES RICHMOND *and* SAMUEL CASWELL, JR., *Taunton, Bristol county, Massachusetts, April 7,* 1831.

To all whom it may concern, be it known that we, Charles Richmond and Saml. Caswell, Jr. have invented an improved mode of

manufacturing spades and shovels by machinery; whereby much labour is saved, and the articles manufactured are made with greater truth and uniformity than by the modes hitherto pursued, and that the following is a full and exact description of our said invention.

The principal machinery which we employ is such as is well known to machinists; and to this, therefore, we make no claim, as we have merely so modified it, in size and form, as to adapt it to the purpose to which we apply it. That our mode of procedure may be perfectly understood, we have deposited in the Patent Office of the United States, drawings of the machinery, as modified and applied by us, and also a model of the same, corresponding with the drawings.

This machinery consists, first, of a cutting press, by which the plate prepared for making a spade, or a shovel, is cut out at one operation; and by another operation is punched, to receive the rivets necessary to attach the back strap and coffer, to the plates.

The second part of the machinery is a stamping apparatus, usually called a drop. This has a bed piece, or anvil, which is fixed below the sliding drop, and forms one part of the die by which the spade, or shovel, is to be shaped; the sliding part of the drop is made to correspond to this, and forms the upper part of the die.

To make a spade, or shovel, we take a bar of Swedish, or other, iron, and upon the side of this we usually weld a piece of steel. The bar is then rolled out to the size necessary for forming the spade, or shovel. It is then placed under the cutting press, and is cut out at one operation.

The same press receives dies to cut the strap, and also to punch the requisite holes, each of which is also effected at one operation.

The plates, so cut, are then placed in the drop, and by a single blow receive the form required.

The improvement which we have made in the manufacture of spades and shovels, and for which we claim a patent, is the use of cutters and dies, used in the cutting press and drop, by which the plate of which the spade, or shovel, is to be made, is first cut out, and afterwards stamped into the proper shape, each by a single operation.

CHARLES RICHMOND.
SAMUEL CASWELL, JR.

Specification of a patent for an improvement in the Standing Press, which the patentee denominates the Inclined Plane Friction Roller Press. Granted to LUTHER CARMAN, *Oxford, Oxford county, Maine, April 7th,* 1831.

To all whom it may concern, be it known, that I, Luther Carman, of Oxford, in the county of Oxford, and state of Maine, have invented an improved press, applicable to a great variety of purposes, which press I denominate the *Inclined Plane Friction Roller Press;* and that the following is a full and exact description of the same.

I construct a frame of wood, or iron, in the ordinary form of frames for presses. That is, having cheeks, or uprights, with a bed piece, or sill, and a cap piece strongly framed into, or otherwise attached to, them. Between the cap piece and bed, a third piece is framed, or attached to the cheeks in the same manner. This third piece may be much smaller than the other two, as it merely operates as a guide and support to the other parts, but does not sustain any of the force of reaction from pressure.

The pressing power is derived from the action of friction rollers against an inclined curved surface, which is effected in the following manner. A strong iron shaft has its gudgeons fitted into holes in the cap piece, and the intermediate piece above named. The lower gudgeon passes through this latter piece, as it is by its descent that the pressure is exerted. The upper gudgeon has sufficient play in the cap piece to allow it to ascend and descend the distance required. A wheel, having a wide rim, is attached to this shaft. The upper edge of the rim of this wheel has two scallops, or indentations, made in it, which correspond exactly with each other, and are made of such depth and inclination as may suit the purpose to which the press is to be applied. Two strong friction rollers are attached to the under side of the cap piece of the press; their faces being in contact with the upper rim of the wheel. The wheel is borne up by means of springs, or weighted levers, or by a rope passing over a pulley, carrying a weight sufficient to counteract that of the wheel and axle.

When this wheel is turned by means of a lever, the friction rollers acting upon the indentation on its rim, will cause it to descend either rapidly or slowly, and with a varying degree of speed, or force, depending upon the degree and form of the inclination in the indented parts of the rim. The two rollers, acting at points diametrically opposite, prevent all strain upon the wheel. Where great power is required, cogs are placed around this main wheel, and a pinion with any number of teeth, is employed to turn it; a lever being applied to the shaft, or axle of such pinion.

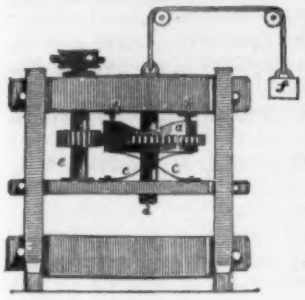
This press may be inverted, in which case the wheel will, by its own weight, rest upon the rollers. It may also, if desired, be made to press in a lateral direction. It is applicable to the purposes of cutting; of raising by means of dies; of printing; pressing bricks, or cheese; and, in fine, to any purpose where great power, and a moderate range, are required.

Cutters, dies, a platten, or follower, &c. may be attached to the end of the shaft, which passes through the intermediate piece above described.

What I claim as my invention, and for which I ask a patent, is the application of friction rollers on the indented edge of a wheel, in the manner, and for the purposes above described.

LUTHER CARMAN.

Carman's Press.



a. The wheel on the rim of which the pressure is exerted.

b, b. Friction rollers bearing against the rim.

c, c. Springs by which the weight of *a* may be sustained.

d. The shaft conveying the pressure by its descent.

e. Pinion, turned by a lever and acting on the teeth of the wheel *a.*

f. A weight which may be substituted for the springs *c, c.*

Specification of a patent for a mode of rendering a variety of articles water proof, by means of Fluid Caoutchouc, and of otherwise using that substance so as to produce new and valuable results. Granted to GEORGE H. RICHARDS, *Washington, District of Columbia, April* 11, 1831.

IT is well known that the substance commonly called gum elastic, or India rubber, but more correctly Caoutchouc, is produced by the desiccation of the sap or juice of several plants, and particularly of the Haevia Caoutchouc, and Jatropha Elastica, growing in the southern part of this continent, and from the Urceola Elastica of Asia. This substance, in the fluid form, has never been applied to the purposes of manufacturing or preparing of many things to which it is peculiarly applicable, although bottles, shoes, boots, balls, and sheets, have been formed thereof in the places where the above named and similar plants grow. It is true, that for the purposes of philosophical experiment, small portions of the juice have been taken to Europe, and brought to this country, but it has never been advantageously employed for purposes of utility, until the same was done by me.

Solutions of the indurated substance, as usually imported, have been made in ether, naphtha, oil of sassafras, spirits of turpentine, the spirits of coal tar, and in other liquids, and a varnish has been thus made which has been occasionally applied to useful purposes. I therefore except from my application and use of caoutchouc, the aforesaid or other solutions, made from the solid material.

In my application of caoutchouc, I obtain it in its original fluid state, and I use it either *substantively*, that is to say, by itself alone, or I employ it in connexion with other substances, as a cement, or as a varnish, for covering, impregnation, saturation, or stiffening. By its use I render the objects to which it is applied either elastic, durable, water proof, or air tight, according to their natures, and the purposes to which they are to be applied.

When used as a cement I sometimes employ it alone, and some-

times I mix it with glue, pitch, tar, or other adhesive articles, and employ it either in a cold or warm state, the latter, or warm state, being in most instances the best.

Without attempting to enumerate, or specify the various objects, or substances, to which I mean to apply the fluid caoutchouc, I will mention a few of them.

I intend to apply it to cloth of every kind, to silk, cotton, ropes, cordage, strings, and all other articles manufactured from fibrous materials. As a varnish to leather, wood, or other porous substances, so as to cover or saturate the same. As a varnish to protect metals from oxidation.

I sometimes mix with the fluid caoutchouc, the metals, metallic oxides, earths, or other solid substances, either simply, or in combination, but generally in a state of minute division, and I thus produce a variety of compound substances, possessing any desired degree of hardness, or combining ornament with utility, according to the nature and objects of the mixture.

The action of atmospheric air, and of solar heat, is sufficient to convert the fluid into a solid substance; but it is best, in general, to facilitate the process, by exposing it to artificial heat. The caoutchouc, or its compounds, may be applied by dipping the article to be covered, or saturated, into it; or a brush may be used in the manner of varnishing. No particular directions are necessary upon this point, as every thing must depend upon the nature of the substance upon which the operation is performed.

I claim as original the useful application of the *native fluid caoutchouc*, as set forth in this specification, either alone or in combination, when employed for the purposes, or in the manner hereinbefore set forth.

GEORGE H. RICHARDS.

Abstract of the specification of a patent for an improvement in the manner of constructing Ships and Vessels of every description, either for the purposes of War or Commerce. Granted to JOSEPH R. DEMING, *City of New York, April 15th*, 1831.

THE improvement consists in uniting together what may be called sundry horizontal frames of suitable timber, placing them one upon another, in such a manner as to make the hull or external part of the ship or vessel, *one solid wall of timber*, with the exception of the bolts and nuts of metal necessary to secure the said frames firmly together. The grain of the timber is, of course, as near as may be in the direction of the line of a figure forming a horizontal section of that portion of the ship or vessel to which it belongs. The frames above mentioned, and which I have spoken of as being horizontal, are not, however, of necessity, of the same vertical thickness one with another; nor as regards any one frame is the vertical thickness thereof, of necessity, the same in its different parts. For as the ver-

tical depth in all, or nearly all, ships or vessels, is greater at the head and stern than it is amidships, it follows, of course, if a ship or vessel be wholly made of entire frames, piled upon, and firmly secured to one another, that the vertical thickness of these frames will be greater at their extremities than in the middle.

In some instances it is proposed to interpose pieces of timber between one or more pairs of frames, particularly at the stern; the grain to run as nearly as may be in the direction of the length of the ship, and also of the curvature of the part in which it is placed.

Two methods of securing the deck beams are given. One by permitting their ends to extend through the sides of the ship, the beams having, if desired, a shoulder on the inside; they are then to be made fast to the hull by screw bolts, dagger-knees, hanger-knees, &c. The other mode is the making the frame in that particular part of the hull sufficiently thick to extend inwards and allow the deck beams to rest on them, and then securing them as above.

This mode of building dispenses altogether with plank, either on the inside, or outside; and also with standing timbers, except it be a stern post, and one or more short pieces underneath the cut water, to serve as a protection from injury to the part called the gripe.

The mode of building is to shape and lay down the keel much in the usual way. At each end of the upper surface, a piece of timber of proper size and shape, forming the *dead wood*, is attached by screw bolts. Pieces extending from one dead wood to the other are made fast to the keel, by screw bolts; these are to be fitted to the dead wood, and to each other, by *butt joints*, *scarf joints*, or *hook scarf joints*. The bolts being so placed that when the vessel is caulked no part of them will be exposed to the action of the water. These pieces, when so fixed, may be considered as constituting the first frame.

A second frame, with dead wood pieces, is then to be laid on the former, and secured by screw bolts long enough to reach through both frames. Pieces of canvass, dipped in white lead paint, or other suitable preservative matter, are to be laid between the timbers as they are bolted together, but this is not to be done to any greater height. The frames are to be laid successively in this way, recesses being made for the heads of the bolts, and the joints all having the canvass, &c. interposed. Tree nails may also be driven as the work proceeds, boring holes diagonally for this purpose. When built to the proper height, the deck beams are to be secured in their places by one or other of the modes above indicated.

When the vessel is completed, the seams are to be caulked, although, from the manner of screw bolting together, it is nearly impossible that any leak can exist. The timbers are, of course, to be so arranged as to *break joints*.

The advantages proposed to be attained are, the using of less timber, and the obtaining of greater strength; to insure tightness even without caulking; to be able to work on the inside, even at sea, by a temporary removal of the cargo, should a leak occur; to make iron bolts less liable to decay, by protecting them from contact with the

water; greater security to persons and property; greater durability, and avoiding the recesses in which foul air is generated.

"*I claim as new*, the foregoing described method of constructing the hull of a ship, or vessel, by uniting timbers piled upon and secured to one another in such manner that the grain of each piece of wood, shall, as near as may be, be in the direction of the part of the said ship or vessel to which it belongs, dispensing with the use of planking, except it be for the decks."

"*I claim as new*, the application of canvass and white lead, or other similar substance, laid in the seams between the timbers, so piled upon and secured to one another by the screw-bolts and tree-nails heretofore and herein described."

"*I claim as new*, the use of screw bolts to fasten together the various series of frames of timber, above described, in manner such that they may be wholly protected from coming in contact with the water; and,—

"*I claim as new*, the plan herein referred to, of constructing the *trunks*, as they are usually termed, made use of when centre boards are employed in ships or vessels; the advantage which this plan offers consisting in the trunk being made of a series of separate pieces of timber, piled upon and secured to each other by screw bolts, &c. as above mentioned, but each piece being morticed through, to receive the centre board; thus making it practicable to render the trunk perfectly tight; a fact which now seldom or never happens."

JOSEPH R. DEMING.

Specification of a patent for a machine for Cleaning Fur. Granted to WILLIAM WOODWORTH *of the city of New York, April* 19, 1831.

THIS machine consists of a series of wheels, like water wheels, placed near each other in a horizontal frame covered in on the top, and bottom, and sides, the cover being as near the periphery of the wheels as may be consistent with their free motion, and lined with a cloth. A feeder is adjusted to one end, and at the same end of the series of wheels, a picker, which takes the fur as the feeder delivers it, and by the rotation of the wheels, with a certain rapidity, and alternately, in opposite directions, the fur is carried through the series, and as it passes on it is freed from the hair, which is attracted by the cloth lining, and adheres to it, so that the fur issues from the other end of the machine perfectly cleared from hair by a single operation, at which other end is placed a gauze bag or other receptacle in some convenient form to receive the fur as it issues. The wheels may be of the same or of different diameters, and of any convenient length; the beaters thereon constructed, like the buckets or paddles of water wheels, may be of any convenient number and dimensions. The wheels, supported on axes or gudgeons, working in boxes, set in the frame, may be of metal or other material. The

frame, made of wood, or other material, consists of two pieces which may be called cheeks: these are supported on a sufficient number of legs, or feet, according to the length of the cheeks, which must be long enough to hold the number of wheels to be used, be they more or less, or larger or smaller. These cheeks are framed together firmly by cross pieces and ties, in such a manner, and of such a length, that the wheels may freely revolve between them, the wheels to be placed at such distances as to revolve freely without touching each other, but as near as may be, consistently with this object. They must be covered in at the ends as well as above and below them—the cover should set close to the top and bottom of the wheels, coming to the sharp angles where the wheels are near each other, and these angles so formed as that the space between the edge of the angles and the wheels will be larger where the fur enters between the cover and the wheels respectively, than where it leaves them respectively. This is convenient, as it favours the passage of the fur from wheel to wheel. The cloth, it is believed, will best answer the purpose which has the coarsest and fullest nap. The attraction and adhesion of the hair to the cloth lining is ascribed to electricity therein produced by the motion of the wheels, and this power of attraction, it is contemplated by the inventor, may be increased in the cloth lining so as to make it electric to any requisite degree by common and known means. The picker, placed as aforesaid, consists of a cylinder with points set therein, so placed in respect to the delivering end of the feeder as to take the fur and tear it from between the delivering rollers of the feeder and distribute it to the wheels as aforesaid. The feeder is of common construction, and the wheels and picker are put in motion by a band running over wheels fixed to their respective axes; the motion of the feeder is adapted to the picker, and the motions of these are adjusted to each other and to the wheels, so that the machine shall have in all its parts a convenient velocity, according to the quantity of fur to be cleared and the supply conveyed to the machine by the feeders in a given time. The number of wheels and their dimensions are left at large, because these may be indefinitely varied, and yet the principle of the machine be the same, as hereinafter is shown. But the number of wheels, and their dimensions, actually used by this applicant in his first operation, were as follows—there were 7 wheels from 6 inches to 2 feet in diameter. The dimensions of the frame, and of the cover, and of the picker, and of the feeder, all obviously depend upon, and are adapted to the number and dimensions of the wheels. By a machine of this description the applicant has cleared fur of hair perfectly in one operation.

The principle of the invention consists in the combination of wheels with a cover lined with cloth, substantially, as above described, having a feeder and a picker of common construction, the dimensions of the same being variable at convenience as aforesaid.

And this applicant contemplates the application of this principle in combination with any common and known apparatus for electri-

fying the cloth lining, and purposes on further experiments to apply for patents for such and other improvements.

WILLIAM WOODWORTH.

Woodworth's Machine for Cleaning Fur.

Fig. 1.

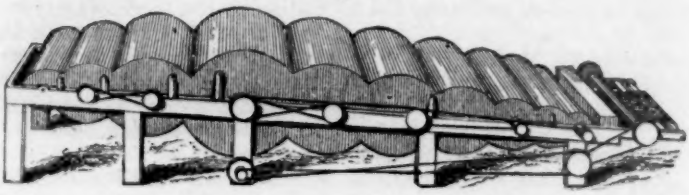


Fig. 2.

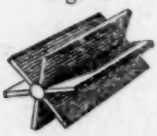


Fig. 1, a perspective view of the whole machine.

Fig. 2. one of the wheels, or beaters, which revolve in the cylindrical cases.

Abstract of the specification of a patent for an improvement in the mode of casting and making of Metallic Tubes, or Pipes, of lead and other soft metals, or composition of metals. Granted to BURROUGHS TITUS, *Ulyssus, Tompkins county, New York, April* 19, 1801.

THE object of this patent is to produce pipes of any desired length, without seam or joints. The plan is to conduct the fluid metal into a mould of a proper form, but of moderate length, and causing the metal to be cooled so as to adhere, and at the same time giving a regular motion to the tube, so as to draw or force it from the mould as fast as it becomes effectually cooled.

The apparatus by which this is to be effected is shown in the accompanying drawing.

A, A, is a hollow cylinder of metal, bored out, so that its inner diameter shall be equal to that of the pipes intended to be cast. Its length for a pipe of $1\frac{1}{4}$ inch, may be about 8 inches. It has a flanch, *a*, *a*, at its lower end. This tube gives the form to the outside of the pipe to be cast. B, is a plug or core, adapted to the inside of the pipe, and made of iron, or other suitable metal; it must be perfectly smooth, and slightly tapering, being smallest at top. It has a flanch, *b*, *b*, adapted to the flanch *a*, *a;* this flanch is perforated with a number of holes, to allow the fluid metal to pass up into the mould. C, C, is a basin to contain water, standing up to the dotted line, *f*, *f*.

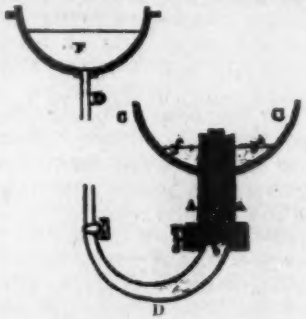
D, D, is a tube by which the melted metal is to be conveyed from the melting pot, F, into the mould. A, stop cock, regulates the flow of the metal. The tube, D, D, is furnished with a flanch, *c*, by which it is connected with the mould.

The melting pot may be placed so high up that the pressure of the melted metal will be sufficient to force the pipe from the mould, with a regular motion, as it is cooled by the water, this force being regulated by the quantity admitted by the stop cock. The pipe, D, D, must descend through a flue kept sufficiently heated to keep the lead in a fluid state, and heat must also be applied at its junction with the mould. Instead of elevating the melting pot, an arrangement may be made for making a mechanical pressure upon the surface of the lead, and thus to produce the same effect.

The pipe, as it is forced off, may be received upon a reel, or drum, placed above the mould.

We have omitted a large portion of the specification, but have given what is necessary to render the plan intelligible. A patent has been obtained in England for machinery for the same purpose, but not of the same construction. We believe that under proper modifications, which experience alone must suggest, the principle above described may be advantageously applied to the accomplishment of the object proposed.

Titus's Machine for Casting Pipes.



ENGLISH PATENTS.

Patent granted to Matthew Uzielli. *The preparation of certain metallic substances, and the application thereof to the sheathing of Ships, &c. Communicated by a Foreigner. Dated January* 6, 1831.

The invention consists in giving ductility and malleability, (for the purpose of making it into sheets,) to an alloy composed of copper and tin solely, or which is so far free from the admixture of zinc or lead, as to be harder and less liable to oxidation than pure copper or common sheet brass, and which alloy is brittle when first cast,

and before it is subjected to the process hereinafter described, but is thereby made into malleable and ductile sheets, which, from their being less liable to oxidation than pure copper, are therefore more applicable to the sheathing of ships, for covering roofs of buildings, making spouts and gutters, and other purposes where sheets are required, which will not be liable to much oxidation.

This alloy I would recommend to consist of copper and tin only; for although an admixture of zinc or lead in small proportions, which will not be sufficient to make an alloy laminable into thin sheets by any process hitherto used, say one or two per cent., will not very materially increase its liability to oxidation, while it renders it a little less brittle, and therefore more easily manufactured, still every little addition will increase its liability to oxidation, and therefore is better avoided: the proportions which I have found best adapted for the purposes before mentioned, are one hundred of copper, with five to seven of tin. A less quantity of tin than about five per cent. makes an alloy which is too liable to oxidation, and is little preferable to pure copper; and a greater quantity than about nine per cent. makes an alloy so hard and brittle, and requires so much care and labour to make into malleable sheets as to become too expensive an article for sale. This alloy is manufactured into malleable and ductile sheets in the following manner:—Having melted the copper in a reverberatory, or any other furnace adapted to the purpose, or in crucibles, the tin is added, as also the zinc or lead, if the alloy is to contain any, and then the metals are to be mixed and well incorporated together by stirring whilst in a state of perfect fusion. The melted mixture, or alloy, is then to be well heated, and a sufficient quantity is to be poured into moulds formed between two strong tables of smooth granite or other suitable substance, so as to obtain a flat plate of from three-eighths to three-fourths of an inch in thickness, according to the ultimate thickness of the sheets required. The thickness, length, and breadth of the plates, may be varied according to circumstances, by the thickness and position of metal rules, which are to be interposed between the tables of granite to keep them apart, and to leave the space which forms the mould for the melted metal. The plates thus cast may be cut into smaller pieces, according to the size of the sheets ultimately required, or the original size of the plates may be adapted thereto, taking care in either case to allow twenty to twenty-five per cent. for waste in the manufacture. It is better that each plate should contain a sufficient quantity of metal to form two or four sheets, so as to be doubled up and rolled in a subsequent stage of the process. These plates are placed in an annealing furnace, or in any other furnace adapted to the purpose, where they are very gradually heated for two or three hours until the plates are raised to a dull red heat, when the alloy contains from five to seven per cent. of tin; but if it contains more tin, the heat must be lower and applied more gradually, and if it contains less tin, the reverse. The plates are then allowed to cool very gradually, which will take about an hour, and when perfectly cold are passed three or four times through the rollers of a suitable rolling-mill,

which are set so as to effect but a very slight reduction of the thickness of the plates. The rollers should be so adjusted during the first cold rolling, after the first annealing, that when the alloy contains the proportions before recommended, of five to seven per cent. of tin, passing these three or four times between the rollers, should not lengthen plates of the thickness before mentioned more than about half an inch in two feet length; but if the alloy contains more tin they must not be lengthened so much, and if it contains less tin, the reverse: great care must be taken that in this and subsequent rollings the plates be rolled always in the same direction. The plates must then be again annealed, taking the same precautions in heating and cooling very slowly, and to the same degree as before, and again rolled in a cold state with the same precautions as to the pressure of the rollers, and in rolling the plates in the same direction as before. The annealing and rolling are repeated with the same precautions, and to the same extent, until the texture of the alloy is changed, as may be known by the fracture being found close and fine grained, instead of crystalline and with facets as when it was first cast. With the proportions before recommended, the close and fine grained texture generally takes place after twelve or fifteen successive operations of annealing and cold rolling. After the texture of the alloy becomes thus changed, it may be heated more rapidly and to a higher temperature, and when cold rolled, so as to lengthen plates, which, when first cast, were of two feet length, six or seven inches after each annealing. The plates, or sheets, as they may be now called, may then be bent up and rolled double, in the usual manner of rolling brass sheets, but continuing always the precaution of rolling in the same direction.

After sufficient rolling the sheets may, if necessary, be doubled again, according to the thickness and size of the sheets required, and when sufficiently rolled, the sheets are to be trimmed and cut to the required dimensions, as usual in rolling brass or copper. The precautions particularly to be observed are casting the alloy in thin plates, heating and cooling them very gradually, and rolling them cold, very gently at first, in the same direction.

Now, I declare, I do not claim as part of the invention the making of sheets of an alloy, which is commonly called brass, and which has heretofore by repeated annealings and cold rollings, in a method somewhat similar to my own, been made into malleable and ductile sheets, but which alloy commonly called brass, is composed of copper, with a large proportion of zinc, or of copper, with a large proportion of zinc and a certain proportion of tin or other metals, but is more liable to oxidation than fine copper, and therefore not so fit for the purposes before mentioned; but I do only claim giving malleability and ductility, for the purpose of making it into sheets, to an alloy which is less liable to oxidation than fine copper or brass, and which heretofore, from its brittle nature, has not been manufactured into sheets.

In witness whereof, &c.

Patent granted to ANDREW URE, *of Southampton Row, in the county of Middlesex, M. D., for an improvement or improvements in curing raw or coarse sugars. Dated October* 20, 1830.

THE nature of this process consists in employing faintly acidulated alcohol as a solvent to remove the quicklime and glutinous extractive with which raw sugars are mingled.

The proportion of acid employed is one ounce of sulphuric, nitrous, or other powerful acid, to one gallon of alcohol, at forty degrees above proof.

The sugar cleared by this mixture, it is stated, will be sufficiently freed from impurities as to admit of its being packed in bags instead of hogsheads.

The claim is not for the use of the alcohol, but for the combination of the latter with the acid for the purpose mentioned.

Patent granted to JOHN DICKENSON, *of Nash Mills, in the parish of Abbot's Langley, in the county of Hertford, for an improved method of manufacturing Paper by means of machinery. Dated October* 6, 1830.

THE object of the present patentee is to make paper in two layers or strata, before such layers leave the felts by which they are conducted to the drying machinery; for this purpose two cylinders of woven wire are immersed in two vats of pulp some distance apart. The pulp collected on the first cylinder is conducted by a felt and the necessary rollers to the second cylinder, from whence the two layers, thus coming in intimate contact, are carried forward by the same felt to the press-rollers, (of which there are two pair,) that form them into a single substance—this is then conveyed to the drying machinery in the ordinary manner.

This method is chiefly applicable to the manufacturing of thick papers, the adhesion being greater when the layers are thus joined, whilst in a wet state, than when united subsequently to their passing the drying apparatus.

Patent granted to ANDREW URE, *of Southampton Row, in the county of Middlesex, M. D., for an Air-stove apparatus, for the exhalation and condensation of Vapours. Dated October* 20, 1830.

THIS invention consists in drawing a stream of air by an exhauster through a chamber over the surface of any moist substance so heated as to exhale vapours, and then propelling the mingled air and vapour through a body of cold water, or other absorbing body, for the purpose of condensation.

The chamber is directed to be constructed of wood, copper, or

other suitable material, and of a rectangular form, (as being most convenient,) and much longer in proportion to its depth. At one end of the chamber, immediately below the roof, is a pipe, through which the vapour exhaled from the substance under operation is extracted; it is connected with an exhauster, which propels the vapour into a cistern where it is condensed. At the opposite end of the chamber to that where the exhausting pipe is fixed, is a sliding door, which may be opened to admit a stratum of air sufficiently thick, according to the intensity of the heating medium, in order to facilitate the exhalation. The substance to be evaporated may be heated by steam pipes or hot water, contained in a second chamber below the evaporator.

This apparatus, it is observed by the patentee, is particularly suited for evaporating raw sugars without injuring their quality.

Patent granted to MICHAEL DONOVAN, *of the City of Dublin, Gentleman, for an improved method of lighting places with Gas. Dated October* 6, 1830.

THE patentee commences his specification by observing, that there are many gases which burn with but a small emission of light, such as hydrogen gas, carbonic oxide gas, and that gas produced by the chemical action of water or steam on the surface of red-hot coke or charcoal. He proposes to produce a good light from these gases by combining them with the vapours of certain volatile substances, such as spirits of turpentine, vegetable resins, naphtha, and naphthaline.

In order that vapour should be produced from these substances, a reservoir is directed to be placed near the burner, so that the heat emitted from the burner itself may produce the necessary effect. The distance of this reservoir from the flame is to be regulated according to the degree of volatility of the substance employed; for, if naphtha be employed that has been several times distilled, it will produce vapour at the temperature of the atmosphere, the reservoir must be in that case removed some distance from the burner, or much smoke will be emitted with the flame, according to the excess of vapour; if, on the other hand, sufficient vapour be not mingled with the gas the light will be less bright.

The gas, (in the instance cited by the patentee,) is generated in a cylindrical iron retort, of about eight inches diameter in the interior, and about three and a half feet in length. This being filled with coke or charcoal, over which water or steam has been thrown, is to be heated to a red heat. The gas thus produced is conducted by a pipe to the lower end of what is termed the recipient, consisting of a small tube or cylinder below the burner. A tube of about half the diameter of this recipient arises concentrically with the latter from the gas supply pipe: this tube, which is perforated with numerous small holes, is denominated the disperser; near the top of this a division is made to prevent the gas from passing through the upper

part without mingling with the vapour, and several convolutions of fine woven wire are wrapped around the disperser to render it more effectual in causing a perfect intermixture. The combined vapours then pass into a burner similar to those usually employed for gas, and it is stated they will then afford a clear and bright light.

New Dye.

We live in an age of improvements. Last week our *Gazette* contained the first public intimation and account of a discovery which promises every man his dram with his bit of bread; since the loaf, in its baking, is found to give out a vapour which needs only to be collected to furnish an excellent spirit. Now, therefore, ovens may also be considered as stills, and the staff of life will be the more required to support those whose heads it may tend to turn by its odorous products. But our present purpose is with a new method of dying with Prussian blue, which is stated to be so efficient and cheap, as entirely to supersede the necessity for indigo. The prospectus issued by the inventors of this commercially important composition is now before us. It states that since the year 1752, the attention of the most able chemists of Europe has been directed to the discovery of some means by which a fast blue dye might be obtained without the use of indigo; but that hitherto their researches have been attended with no favourable results, inasmuch as the use of Prussian blue, (the only substitute that could be used,) has been found to render the wool too hard to work well, and at the same time to burn it. But the inventors, who, we believe, have secured their discovery by a patent, assure us that their experiments have succeeded, and that they are prepared to submit to the public, specimens of blues, which have been produced without indigo; the tints of which are equal, if not superior to any colour that has yet been produced by that dye, and its durability incomparably superior. Specimens, they add, will be produced of clothes that have been worn until there literally remained but the thread, and yet the colours are as firm as when first the cloth was cut, nor is there the slightest appearance of white upon any of the seams; a fastness of dye which has never been produced by indigo. We ought to mention that these specimens have been exhibited to us, and that they fully bear out the description given. Among the advantages which the proprietors promise from the adoption of this dye, are the following:—All the substances which compose it are indigenous to all countries, are abundant and cheap, not only in consequence of their great plenty, but also from many of them being absolute refuse, such as old woollen rags, meat unfit for use, blood, entrails, and, in fact, every description of animal matter, however corrupt may be its state:—as a new branch of industry, the manufacture would be a national benefit:—a much greater solidity, beauty, and brilliancy of colour, than hitherto attained, and a capability of being brought to any tint required:—in an apparatus of equal capacity, three times more wool can be dyed by this process

in a given time, and at an infinitely less cost than can be dyed by indigo:—wool dyed by the new process is in every respect better to work, is softer, cards better, and is more pleasant and easy to weave than when dyed with indigo:—it is not only applicable to blues, but is equally efficient as the foundation for blacks and greens; those colours being produced of the most beautiful tints;—for hats, the beauty and intensity of the black it produces, and the rapidity with which the operation of dying is performed, renders the discovery invaluable to that branch of trade. Such are the advantages proposed by the adoption of this process; and assuredly a discovery which would lower the price of articles of universal consumption and in constant use, and open a home employment of great extent, in the room of foreign and imported produce, is well worthy of the consideration of a commercial people. We can only speak of the thing from what we have seen, and the old and new clothes shown to us seemed completely to warrant the pretensions which accompanied them. We have no doubt but that both practical skill and large capital will soon put this novelty to the test; and were it ours, we should not be afraid to "stand the hazard of the die." [*Lit. Gaz.*

The Monthly American Journal of Geology and Natural Science.

Two numbers of the above Journal have issued from the Philadelphia press, under the editorial management of G. W. Featherstonhaugh, Esq. We hailed the work in advance as likely to promote the knowledge of a very interesting department of science, but we have to regret that the editor has already given proof of a total absence of those dispositions and habits without which a person is altogether unfit to become one of the sentinels of science. In his notice "*to readers and correspondents*," he has charged this Journal with having "become the vehicle of defamation in its most insidious form," and has designated one of the most usefully active members of the Franklin Institute, as "one of the most insignificant of their members," "an intriguing pharasaical individual," an utterer of "*a deliberate falsehood*," "a mendacious little individual," and "a parasite who lives by dishonouring the labours of others." The original offence of the gentleman so designated, was his differing in opinion with Mr. Featherstonhaugh respecting the organic remains of an extinct species of animal; which offence he aggravated by openly defending his opinions before the Philosophical society.

Mr. F. no doubt imagines that the *provocation* which he has received, will suffice to justify the coarse epithets, and personal abuse, to which he has resorted; we apprehend, however, that to this opinion he will make but few proselytes. He appears to have forgotten "the divine feelings of religion,"* and certainly endangers the accomplishment of his main purpose, which he tells us "is not to win opinions from a limited number of selfish individuals, more interest-

* P. 91, Journal of Geology.

ed in *humbugging* the public than in enlightening it."* We hope that when he endeavours "to instruct and amuse the millions,"* he will perceive the necessity of uttering the lessons of wisdom with the tone of a gentleman, and in the elevated language which belongs to the real philosopher.

Meteorological Observations for July, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches				Inches	
☾	1	68°	76°	30.00	30.00	64	SE.	Moderate.	.4	Rain—cloudy.
	2	69	79	.20	.00	70	SE.	do.	.6	Cloudy—rain.
	3	70	72	.20	.00	71	S. W.	do.	.11	Fog—shower.
	4	72	82	.20	.10	71	SW.	Breeze.		Fog—clear.
	5	72	83	.5	30.00	69	SW.	do.		Clear—flying clouds.
	6	71	76	29.90	29.85	68	SW.	do.	1.00	Cloudy—rain. Rain night,
	7	72	74	.80	.80	73	SW. SE.	Moderate.	4.30	Cldy—rain. [thun. &light.
	8	72	80	.85	.85	74	SE.	do.	.66	Fog—Flying clouds.
	9	72	74	.75	.75	70	SE. SW.	do.	.90	Rain night, thun. & light.
⊗	10	57	71	.80	.90	50	W. SW.	do.	.71	Drizzle—cloudy—rain.
	11	53	71	30.10	30.16	47	NNW. N.	do.		Clear—flying clouds.
	12	53	74	.20	.20	49	W. SW.	do.		Clear day.
	13	54	72	30.00	30.00	51	SW. S.	do.		Clear day.
	14	62	77	29.84	29.80	60	N. W.	do.		Clear day.
	15	66	78	.75	.75	63	W. W.	do.		Clear day.
	16	63	75	.90	.90	49	W. W.	Breeze.		Clear day.
	17	60	78	.83	.83	57	W. W.	do.		Clear day.
	18	65	79	.83	.74	69	W. W.	Moderate.	.7	Clear day.
	19	72	86	.75	.75	64	W. W.	Breeze.		Clear day.
	20	71	86	.75	.75	66	W. W.	do.	.8	Clear—shower.
	21	70	86	.70	.72	66	W. W.	do.		Clear day.
	22	71	86	.72	.66	66	W. W.	do.		Clear day.
☽	23	72	85	.70	.60	70	S. W.	do.	47.	Cloudy—showery.
	24	70	82	.70	.80	65	W. W.	Moderate.		Clear day.
	25	63	81	.80	.83	634	W. W.	do.		Clear day.
	26	74	80	.60	.63	66	W. W.	Breeze.	.7	Cloudy—thunder shower.
	27	72	84	.80	.80	66	S. W.	do.		Clear—overcast.
	28	73	82	.83	.80	73	W. W.	do.		Clear—cloudy.
	29	70	82	30.00	30.00	61	W. W.	do.		Clear day.
	30	69	84	.90	.00	64	W. W.	do.		Clear—shower.
	31	72	87	30.00	29.90	73	SW.	do.	.15	Clear—shower.
	Mean	67.37	79.42	29.88	29.86	64.3			8.67	

	Thermometer.		Barometer.	
Maximum height during the month,	87.	on 31st	30.16	on 11th.
Minimum do.	71.	on 10th and 11th.	29.60	on 23d.
Mean do.	73.34		29.87	

* P. 91, Journal of Geology.